THE WEATHER AND CIRCULATION OF MAY 1958 [1]

Reversal from a Long-Period Regime

JAMES F. ANDREWS

Extended Forecast Section, U. S. Weather Bureau, Washington, D. C.

1. INTRODUCTION

May 1958 was characterized by reversal from a weather and circulation regime which had persisted since January 1958. Such persistent regimes, lasting for a period of several months, are not uncommon and have been treated in previous articles of this series. The transition from a weather pattern more characteristic of winter than spring actually began during April and was completely effected by May. This article describes the transition which occurred, treating in more detail the reversal from April to May. The average monthly weather and its relation to the mean circulation are then discussed, followed by a comparison of tornado activity with May of 1957 and a discussion of intramonthly changes in circulation and weather.

2. CIRCULATION REVERSAL FOLLOWING LONG-PERIOD PERSISTENCE

The evolution of recent long-period circulation regimes is well illustrated by the westerly wind profile of the general circulation. In figure 1 is shown a time-latitude section of zonal wind speed at 700 mb. averaged over the Western Hemisphere on a series of overlapping 30-day mean charts prepared twice monthly. Late in 1957 the primary axis of westerly wind speed, or jet stream, shown in the illustration as a heavy solid curve, was some 5° north of its normal position (dashed curve). This was followed by an abrupt southward displacement of the maximum westerly wind belt to a position well south of normal with minimum latitude reached during the mean monthly period January–February 1958. This pronounced southward shift of the westerlies was related to an extensive index cycle which has been described in detail by Klein [1]. The 700-mb. jet remained well south of normal until late March when a steady progression northward began. From April to May the recovery was very rapid, and the jet during May reached a position 8° north of its normal location. Thus, from January to April the primary westerly wind jet at 700 mb. remained well south of its normal position, and the long index cycle which began during December 1957 was not finally completed until May of 1958.

[1] See Charts I–XVII following p. 196 for analyzed climatological data for the month.

During the period January to April 1958 the zonal index, a measure of the mean geostrophic westerly flow between latitudes 55° N. and 35° N. in the Western Hemisphere, remained well below normal at both 700 mb. and sea level, as shown in table 1. As a matter of fact the minimum values reached by both these indices during March were the lowest ever observed on monthly mean charts during a period of record dating back to 1942. The sea level value did, however, equal that observed for the monthly period from mid-February to mid-March during the abnormal winter of 1946–47 [2]. By considering shorter time periods it can be seen that the zonal index during its current recovery reached a peak value at 700 mb. of 10.0 m. p. s., 2.4 m. p. s. above normal, during the 5-day period May 8–12. This represents the greatest positive anomaly of this index since December 19–23, 1957, when the value reached was 14.3 m. p. s., 2.9 m. p. s. above the monthly normal.

The rapid migration northward of the maximum westerly wind belt from April to May is further illustrated by comparing the zonal wind speed profiles at 700 mb. for these months (fig. 2). It is seen that on a mean monthly basis the west-wind maximum was displaced northward some 12° of latitude, a considerably greater displacement than normally occurs between these two months. The mean 700-mb. isotachs and their departure from normal, as derived from the average 700-mb. map for May, are portrayed in figure 3. Superimposed on the isotach chart are the primary jet stream positions for May and April. The marked northward shift of the primary jet from the eastern Pacific to the central Atlantic was very striking, averaging about 20° of latitude in the

TABLE 1.—*Monthly mean values of zonal indices in the Western Hemisphere (in meters per second)*

Month	700 mb.			Sea level		
	Index	Normal	Anomaly	Index	Normal	Anomaly
December 1957	12.7	11.3	+1.4	5.7	4.3	+1.4
January 1958	9.1	11.8	−2.7	3.0	4.1	−1.1
February 1958	7.0	10.2	−3.2	1.2	3.4	−2.2
March 1958	5.3	9.1	−3.8	[1] −0.1	2.8	−2.9
April 1958	7.9	8.3	−0.4	2.4	2.5	−0.1
May 1958	8.0	7.7	+0.3	2.5	2.5	0.0

[1] Represents net easterly flow.

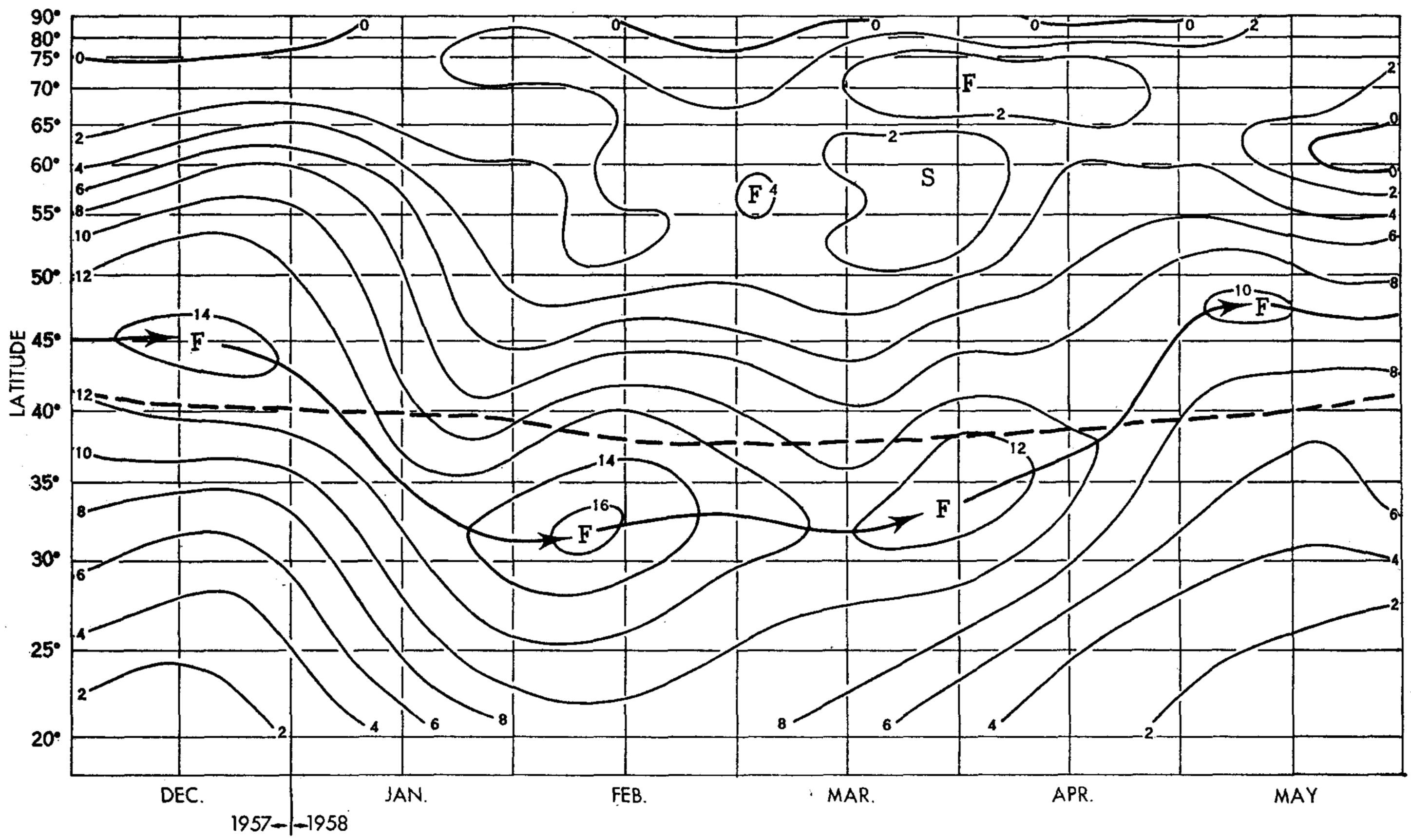


FIGURE 1.—Time-latitude section of 30-day mean zonal wind components averaged over the Western Hemisphere at 700 mb. Wind speeds were computed twice-monthly in 5° latitude belts from the period mid-November to mid-December 1957 until the period mid-May to mid-June 1958. Isotachs are in meters per second with easterly winds negative. Centers of maximum and minimum west wind speed are labeled F and S respectively. Evolution of the axis of maximum westerlies (heavy solid curve) and its position relative to normal (broken line) was closely related to changing weather regimes.

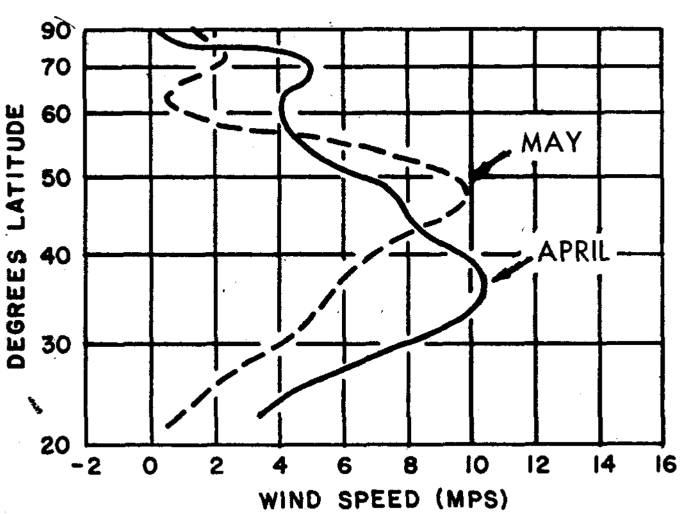


FIGURE 2.—Mean 700-mb. zonal wind speed profiles in the Western Hemisphere for April (solid line) and May 1958 (dashed line). Rapid northward shift of the belt of maximum westerlies is evident.

United States. During April [3] maximum wind speeds were centered over the Gulf States, while in May the strongest winds were over the Great Lakes where speeds were as much as 6 m. p. s. above the normal (fig. 3B).

A similar change occurred in the high-level wind pattern, but with some differences. For instance, at 200 mb. the jet axis during April (not shown) was well established and slightly south of its 700-mb. counterpart from the eastern Pacific to the western Atlantic. This jet axis persisted in low latitudes during May (fig. 4), although much weaker, while a new, higher-latitude jet appeared near the location of the 700-mb. wind maxima. The low-latitude jet axis now extended across the entire Western Hemisphere, its only complement at 700 mb. being a weak speed maximum in the eastern Pacific. In this area wind speeds in the 200-mb. jet reached 30 m. p. s. at the base of a pronounced trough in the westerlies (fig. 4).

The April–May reversal in the general circulation is also illustrated by figure 5, which represents the change in 700-mb. height anomaly from April to May 1958. In North America the greatest anomalous height change was the fall of 320 ft. centered over southern Hudson Bay. Here persistent blocking since January finally gave way to an abnormally deep cyclonic vortex in May (fig. 6). The band of height falls from eastern Canada to Alaska, in conjunction with a band of middle-latitude height rises from the western Atlantic to the central Pacific, were intimately related to the abrupt northward shift of the mid-latitude westerlies. In the eastern Pacific the anomalous height change pattern of rises in the middle latitudes and falls at low latitudes was associated with a strongly difluent circulation, not only at 700 mb. (fig. 6) but also at 200 mb. (fig. 4) and a related split in the westerlies (figs. 3 and 4).

3. TEMPERATURE REVERSAL IN THE UNITED STATES

The reversal in circulation from April to May was accompanied by an equally pronounced change in temperature. This is best seen by comparing the monthly mean temperature anomalies observed in the United States during the two months, as shown in figure 7. Northeast of a line from the Dakotas to Virginia the above norma temperatures of April gave way to subnormal temperatures during May, while to the southwest of this line most of the Nation experienced a change to warmer weather. The area of greatest change occurred in the Rocky Mountain States and the eastern portions of Washington and Oregon where temperatures rose as much as 9° F. (relative to normal) (fig. 7C). In the Northeast and Upper Lakes region the anomalous temperature change was as much as 7° to 8° F. cooler. In terms of temperature class change only 46 cities out of a possible 100 remained in the same or adjacent class (out of five) from April to May. This is considerably less persistence than that expected either by chance (59) or the 1942–57 average (62). Such abrupt transitions in large-scale weather regimes are quite common during this season of the year [4], other recent examples of April-May temperature reversals having occurred in 1954 and 1956 [5, 6].

4. AVERAGE UNITED STATES WEATHER AND ITS RELATION TO THE MEAN CIRCULATION

TEMPERATURE

May temperatures averaged below seasonal normals in the northeastern quarter of the Nation and along the Atlantic coastal plain to Florida (fig. 7B and Chart I–B). Greatest departures, 3° F. or more, were observed in parts of New York and New England. At Columbus, Ga., a temperature of 40° F. on the 8th was the lowest ever observed during May in a station record which dates back to 1889. New daily minimum temperature records were established at several cities, including Portland, Maine, Toledo, Ohio, and Erie, Pa., on the 26th; Sault St. Marie, Mich., on the 2d and 29th; and Albany, N. Y., on the 10th.

This unseasonable coolness can be related quite readily to the mean circulation patterns. For instance, stronger than normal northwesterly flow prevailed between the ridge in western North America and the trough in eastern North America (figs. 4, 6). Wind speeds in the principal axis of this flow were higher than normal, as much as 6 m. p. s. greater over the Great Lakes at 700 mb. (fig. 3B). At sea level polar continental anticyclones were steered into the Northeast from central Canada by this controlling current, each anticyclone bringing with it a fresh outbreak of cold air. Tracks of these anticyclones are shown in Chart IX. As might be expected, the area of subnor-

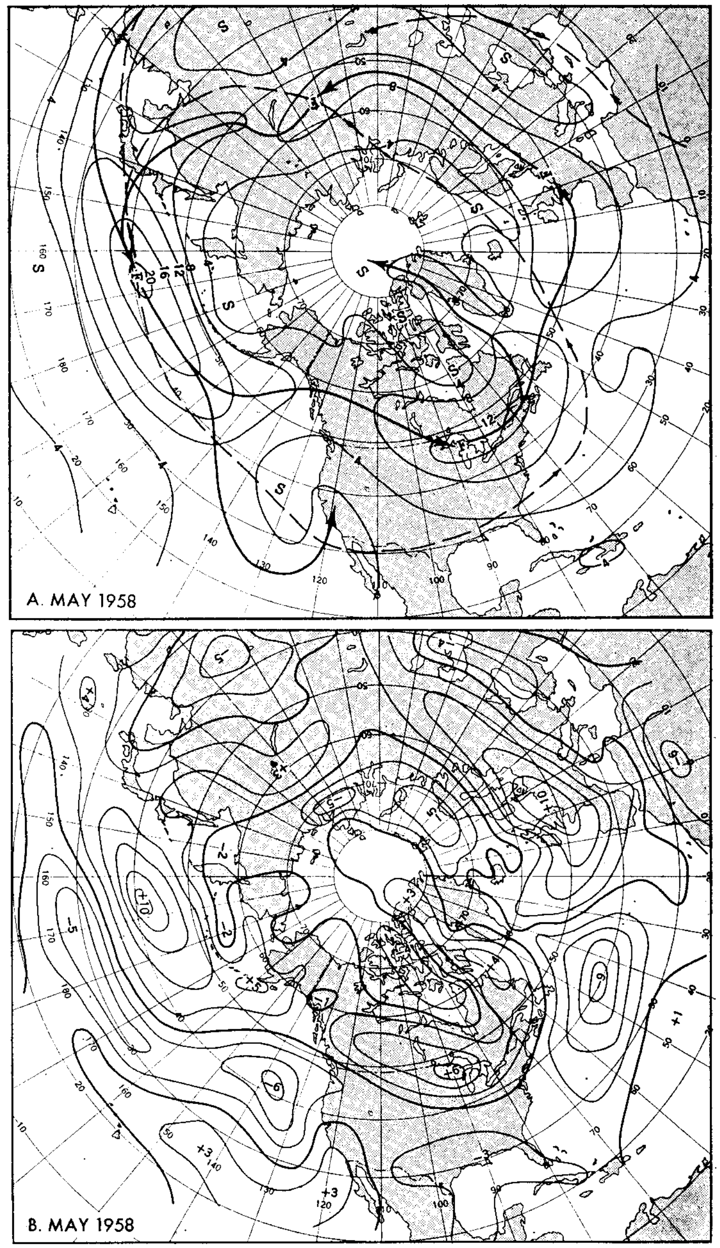


FIGURE 3.—(A) Mean 700-mb. isotachs and (B) departure from normal wind speed (both in meters per second) for May 1958. Solid arrows in (A) indicate major axis of westerly jet during May 1958, while dashed arrows show mean position of corresponding jet during April 1958. Difluence in eastern Pacific and northward displacement of jet stream from April to May are notable features.

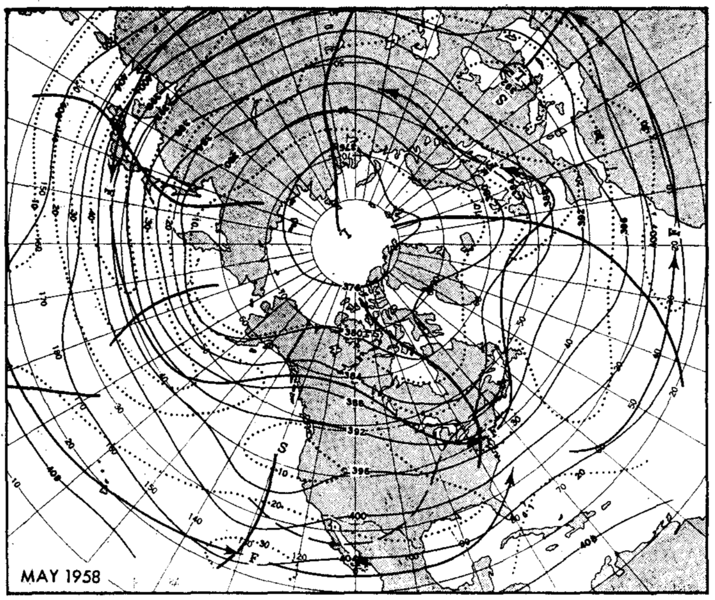


FIGURE 4.—Mean 200-mb. height contours (solid, in hundreds of feet) and isotachs (dotted, in meters per second) for May 1958. Solid arrows indicate average position of the 200-mb. jet stream, while dashed arrows show its position across North America in May 1957. Note marked displacement of jet stream in United States from May 1957 to May 1958.

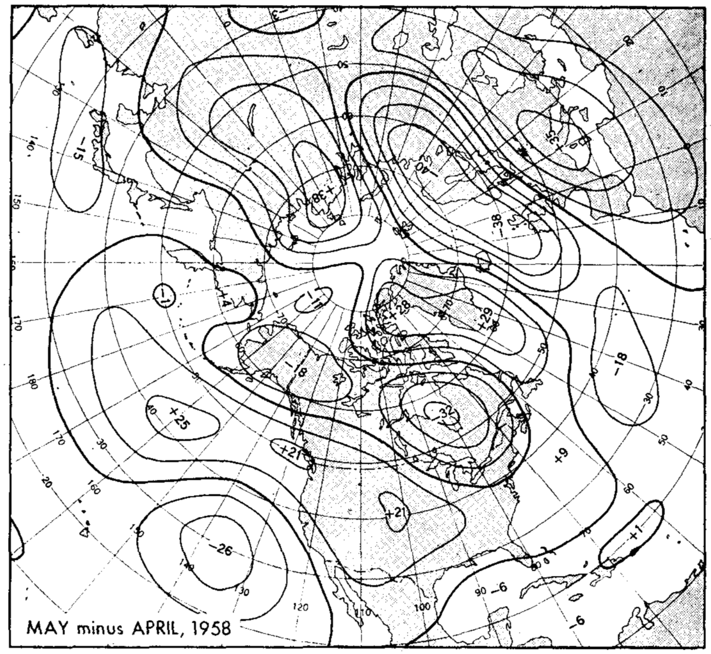


FIGURE 5.—Mean 700-mb. anomalous height change (in tens of feet) from April to May 1958. Areas of large change were related to marked reversal of the planetary circulation.

mal surface temperature corresponded quite well with the departure from normal of mean thickness in the layer between 1000 mb. and 700 mb. (fig. 8). This chart indicates that the greatest negative thickness anomaly in North America was centered over southwestern Quebec, where the greatest negative surface temperature departures were also found.

The Gulf States experienced temperatures generally near the seasonal normals. This normality corresponds with near-normal values of 700-mb. height (fig. 6) and 1000 mb.–700 mb. thickness (fig. 8).

Elsewhere in the country temperatures averaged above normal (fig. 3B and Chart I–B). Greatest departures, 8° F. or more, were observed from western Montana to northeastern Washington, but the +6° F. isotherm embraced a large area of the Far West (Chart I–B). Many monthly mean temperature records for May were established, some of which are listed in table 2. In addition, daily maximum temperature records for individual dates were set, but these are too numerous to mention.

TABLE 2.—*Selected cities reporting warmest May on record during 1958*

Station	Mean temperature (°F.)	Anomaly	Years of record
Tucson, Ariz.	79.1	+6.0	67
Winslow, Ariz.	67.8	+5.8	69
Yuma, Ariz.	84.9	+4.5	81
Los Angeles, Calif.	68.0	+3.2	80
Helena, Mont.	60.7	+8.4	78
Kalispell, Mont.	60.3	+7.9	59
Seattle, Wash.	62.3	+5.0	66
Walla Walla, Wash.	66.5	+5.3	86

This extensive area of abnormal warmth was associated with a generally anticyclonic circulation pattern that extended well into upper levels of the atmosphere (fig. 4 and Charts XII to XVII). Accompanying factors were above normal values of height (fig. 6), thickness (fig. 8), and sunshine (Chart VII); while at sea level a somewhat stronger than normal southwesterly flow also contributed to the warming (Chart XI, inset).

PRECIPITATION

Because precipitation is discontinuous and the physical processes relating to its production are much more complex than those for temperature, this element is more difficult to relate to time-averaged charts for periods as long as a month. During May 1958 perhaps the easiest to explain are the heavy amounts which fell from the Lower Mississippi Valley to southern New England (Chart II). These were related to the mean troughs near the Atlantic coast and in the Gulf of Mexico (figs. 4 and 6). Two storm systems moving across the Southeast early in the month (Chart X) brought sufficient precipitation to result in flooding in many areas. Most serious flooding developed in southwestern Virginia, eastern Kentucky, and southern West Virginia. Streams also ran high in portions of Pennsylvania, Ohio, and Indiana. As a result of these floods the Ohio River at Cincinnati, Ohio, reached a record crest for May of 58.0 ft. on the 10th. In North Carolina the Neuse and Tar Rivers reached their highest stages in several years. Continuing rains after mid-month in the Lower Mississippi Valley caused the Ouachita River in Louisiana to crest at near record levels.

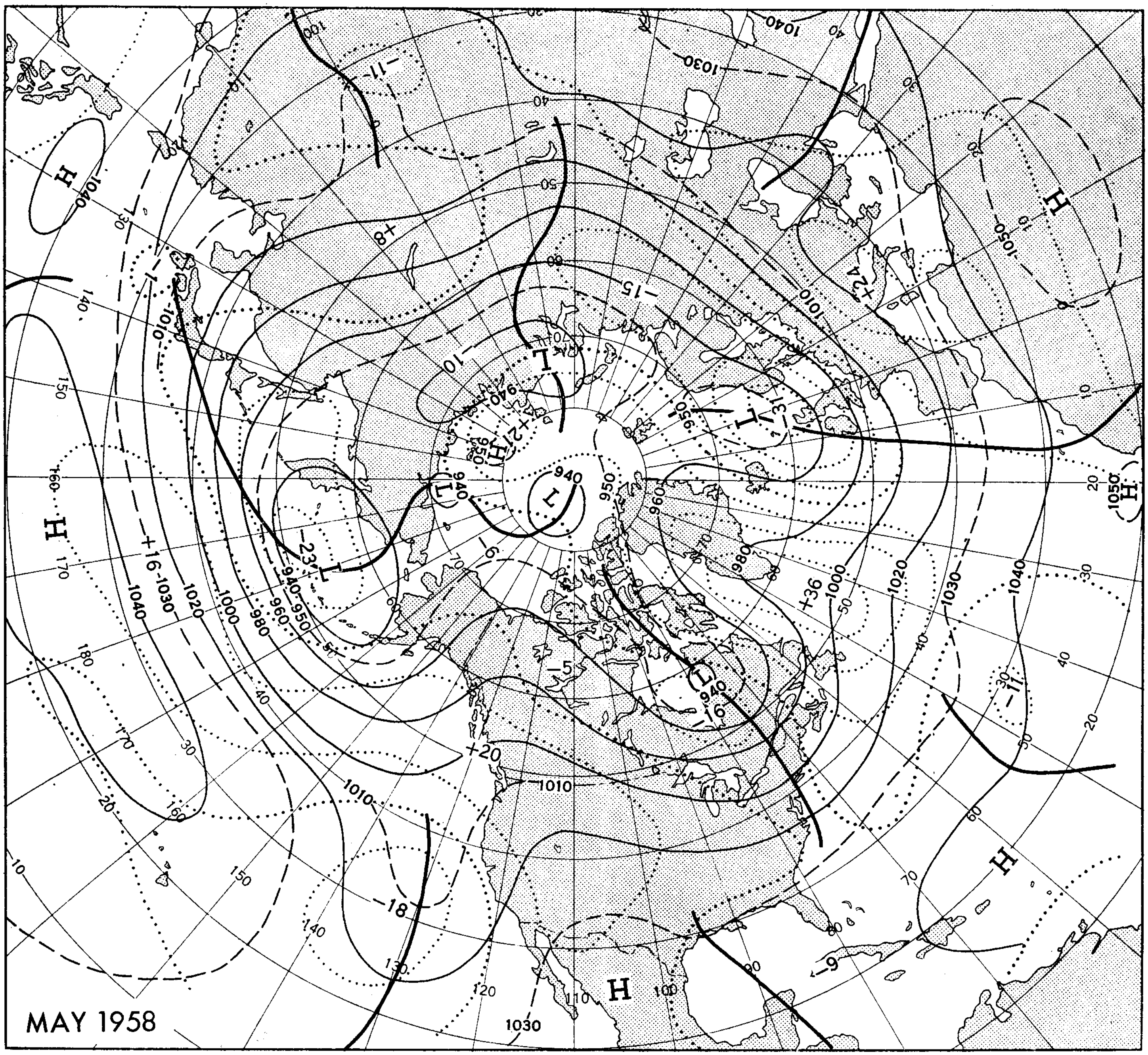


FIGURE 6.—Mean 700-mb. height contours (solid) and departure from normal (dotted) (both in tens of feet) for May 1958. Principal circulation features in North America were stronger than normal ridge in the West and deeper than normal trough in the East.

At Boston, Mass., the period January through May was the second wettest for any comparable period since observations began in 1872. Of interest also is the fact that no thunderstorms occurred there for the first time in the last 35 Mays. This was the second wettest May since records began in 1911 at Miami, Fla., more than half the month's total precipitation falling in connection with a tropical depression that developed in the Caribbean Sea and moved northward off the Atlantic coast (Chart X). A detailed treatment of this storm appears elsewhere in this issue.

470451—58——3

Heavier than normal amounts of precipitation also fell from central Wyoming to western Texas and in California and western Arizona (Chart III-B). Much of this can be attributed to the eastward passage of several short-wave troughs from the Pacific. Precipitation along the immediate Pacific coast was associated with the deep trough in the eastern Pacific (figs. 4, 6).

From the Great Lakes westward, precipitation was generally light with May totals averaging about 50 percent of normal (Chart III–B). This deficiency can be related to anticyclonic flow with above normal heights and to

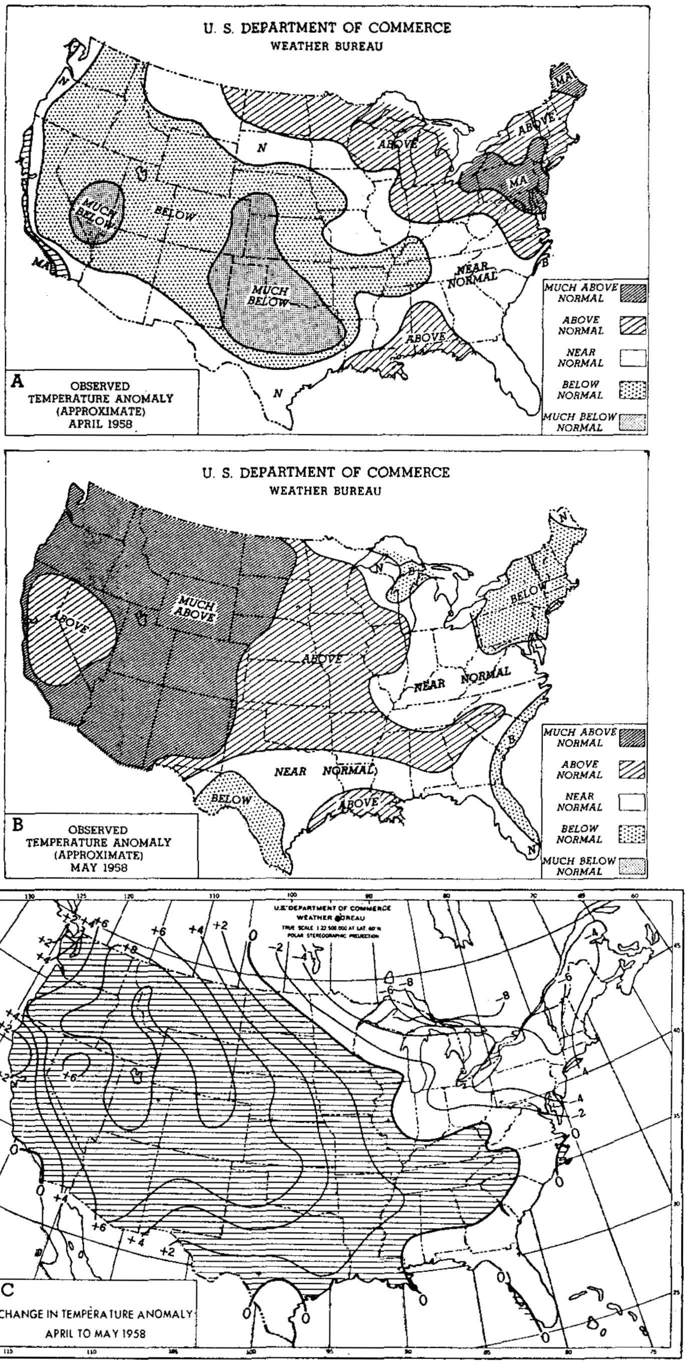


FIGURE 7.—Monthly mean surface temperature anomalies for (A) April 1958 and (B) May 1958. (The classes above, below, and near normal occur on the average one-fourth of the time; much below and much above each normally occur one-eighth of the time.) (C) Change in temperature anomaly (° F.) from April 1958 to May 1958. Note pronounced warming throughout most of the West and cooling in the Northeast.

stronger than normal northwesterly flow (fig. 6). In addition, in the Far Northwest, displacement northward of the 700-mb. jet stream (fig. 3A), plus lack of migratory cyclones (Chart X), reduced the normal orographic effect. Glasgow, Mont. experienced its driest May since 1911, while at Milwaukee, Wis., the first 29 days of the month

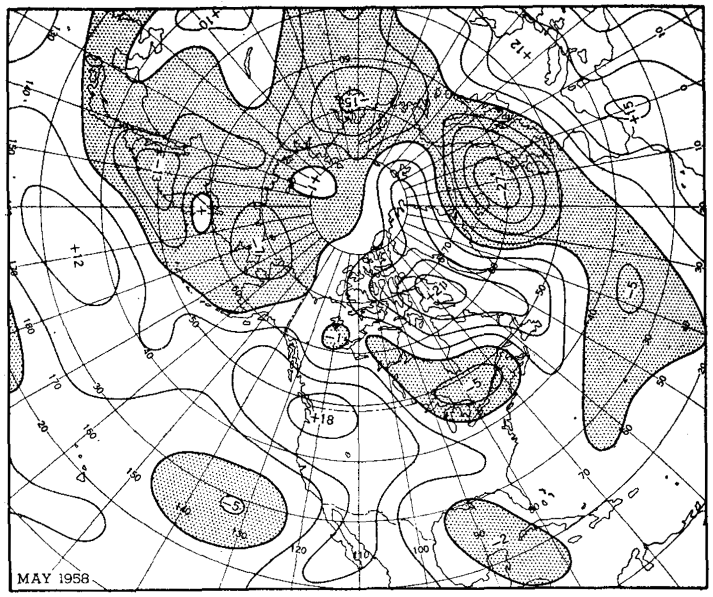


FIGURE 8.—Departure from normal of monthly mean thickness (tens of feet) for the layer 1000–700-mb. for May 1958, with subnormal values stippled.

were the driest on record for a comparable period since 1870. In the latter city the percentage of possible sunshine (88) was the highest for any May (Chart VII).

The region from the Great Lakes to central Montana has been deficient in precipitation since the first of the year, this being the driest January to May period since 1871 at Detroit, Mich. and the second driest December to May period since 1891 at Minneapolis-St. Paul, Minn. In table 3 are given the total and percentage of normal precipitation for selected stations in the northern interior for May and the period January to May inclusive. No one simple feature of the general circulation can explain completely this persistent anomaly, but it was probably related to the presence of a stronger than normal ridge in western North America and a mean trough near the Atlantic coast of North America. In addition, persistent blocking in eastern Canada served to displace the westerlies (fig. 1) and associated storm tracks across the southern United States.

TABLE 3.—*Total (inches) and percentage of normal precipitation for selected stations in northern interior United States* [1]

Station	May 1958		January to May 1958	
	Total	Percent	Total	Percent
Chicago, Ill.	3.12	85	6.54	52
Fort Wayne, Ind.	1.88	55	7.37	52
Alpena, Mich.	1.14	43	4.22	42
Detroit, Mich.	1.16	32	4.79	36
Minneapolis, Minn.	1.39	45	4.15	51
Glasgow, Mont.	.03	2	1.36	35
Devils Lake, N. Dak.	1.02	48	2.57	50
Williston, N. Dak.	.06	4	1.95	44
Sioux Falls, S Dak.	.81	24	6.13	72
Green Bay, Wis.	1.27	50	4.91	52
La Crosse, Wis.	1.07	33	4.37	45
Milwaukee, Wis.	2.07	69	5.93	57

[1] Data from *Weekly Weather and Crop Bulletin, National Summary*, vol. XLV, No. 22, June 2, 1958.

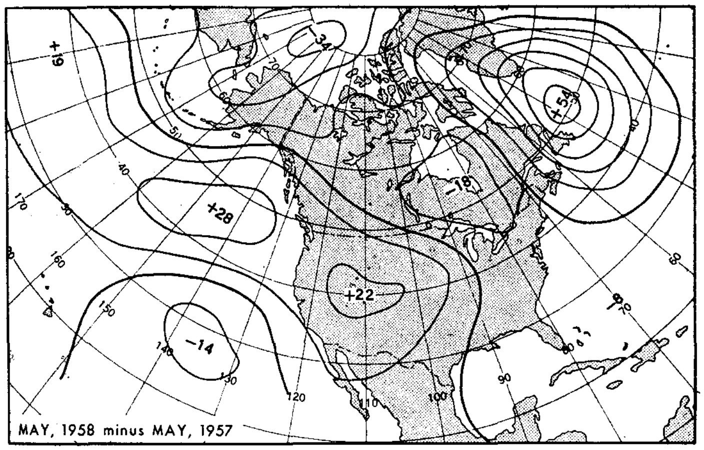


FIGURE 9.—Difference in mean monthly 700-mb. height from May 1957 to May 1958 (in tens of feet). Contrasting weather regimes accompanied change in the general circulation.

5. TORNADO ACTIVITY—A COMPARISON WITH MAY 1957

Tornado occurrences in the United States during May 1958 were considerably less frequent and severe than they were in May 1957. This continues a trend begun in March of this year [3]. Comparative data on the number of tornadoes show that there was a 60 percent reduction in the number reported between May 1957 and May 1958 (see table 4).

Much of this decrease in tornado activity can be attributed to marked differences in the general circulation between the two months. During May 1957 [7] synoptic, thermodynamic, and dynamic considerations were all, on the average, more favorable for tornado development than they were during May of 1958. For instance, the mean trough in the West and ridge in the East in May 1957 were replaced by a ridge-trough system in May 1958. Figure 9, the mean monthly 700-mb. height change between these two months, shows increased flow of dry air from the north which inhibited tornado development.

The thermal field associated with this circulation reversal also underwent a sharp transition—from temperatures well below normal in the Southwest last May to temperatures much above normal this May. Furthermore, the strong horizontal temperature gradient in the central and southern Plains in May 1957 was absent in May 1958. In addition, the average position of the jet stream in May 1957 [7] (fig. 4) was over the central and southern Plains States where tornadoes generally occur most frequently. In May 1958 both the mid-tropospheric jet (fig. 3A) and upper-level jets (fig. 4) were well removed from the Plains States.

TABLE 4.—*Number of tornadoes and funnel clouds observed in the United States during May 1957 and May 1958*

Period	Tornadoes	Funnels	Total
May 1957	230	253	483
May 1958	91	103	194

Examination of the mean monthly 700-mb. charts for all Mays back to 1933 reveals that the full-latitude ridge over western North America (fig. 6) was the strongest ridge ever observed in that area. A similar circulation pattern in May 1940 was associated with the fewest tornadoes in any May since 1933. Thus, while May 1957 produced a record number of tornadoes at a time when the general circulation was most favorable, May 1958 saw a sharp decrease in these storms when the circulation was highly unfavorable. There is little doubt that frequency of occurrence of tornadoes can be related to time-averaged charts for periods as long as a month.

6. CIRCULATION AND WEATHER FEATURES ELSEWHERE IN THE HEMISPHERE

A strong blocking-type ridge, with a large area of positive height anomaly centered off southern Greenland, featured the monthly mean circulation in the Atlantic (fig. 6). Pressures at sea level associated with this ridge were also well above normal, as much as 10 mb. (Chart XI, inset). An extensive area of subnormal wind speeds prevailed at 700 mb. over the southern portion of the Atlantic (fig. 3B), related in part to the low-latitude trough near 52° W.

The weather in northwestern Europe was controlled largely by the deep cyclonic center of action over the Norwegian Sea where 700-mb. heights were 310 ft. below the May normal (fig. 6). The trough emanating from this center extended southward to the African coast where 700-mb. heights were well above normal. This was part of an area of above normal heights extending across southern Europe which, in conjunction with negative anomaly to the north, combined to produce strong westerlies across central Europe. Wind speeds in this jet were as much as 10 m. p. s. above normal (fig. 3). As in North America, the circulation features discussed represented a sharp reversal from the April patterns. This is most apparent when one examines the anomalous 700-mb. height change for this area (fig. 5). In addition, the zone of strongest west winds over the Mediterranean in April was now displaced northward to central Europe (fig. 3A).

Frequent severe cyclones, moving along a path just north of the primary jet (fig. 3A), swept across northern Europe, and sea level pressures averaged 7 mb. below normal in Norway. An abnormally strong northerly flow between the Atlantic ridge and the Norwegian Sea Low brought subnormal temperatures to northern Europe. The lowest temperatures, relative to normal, were observed just north of the British Isles where temperatures in the layer from 1,000 mb. to 700 mb. averaged 9° C. below normal (fig. 8). Over southern Europe, where the flow was generally anticyclonic and pressure above normal, temperatures averaged well above the May normal.

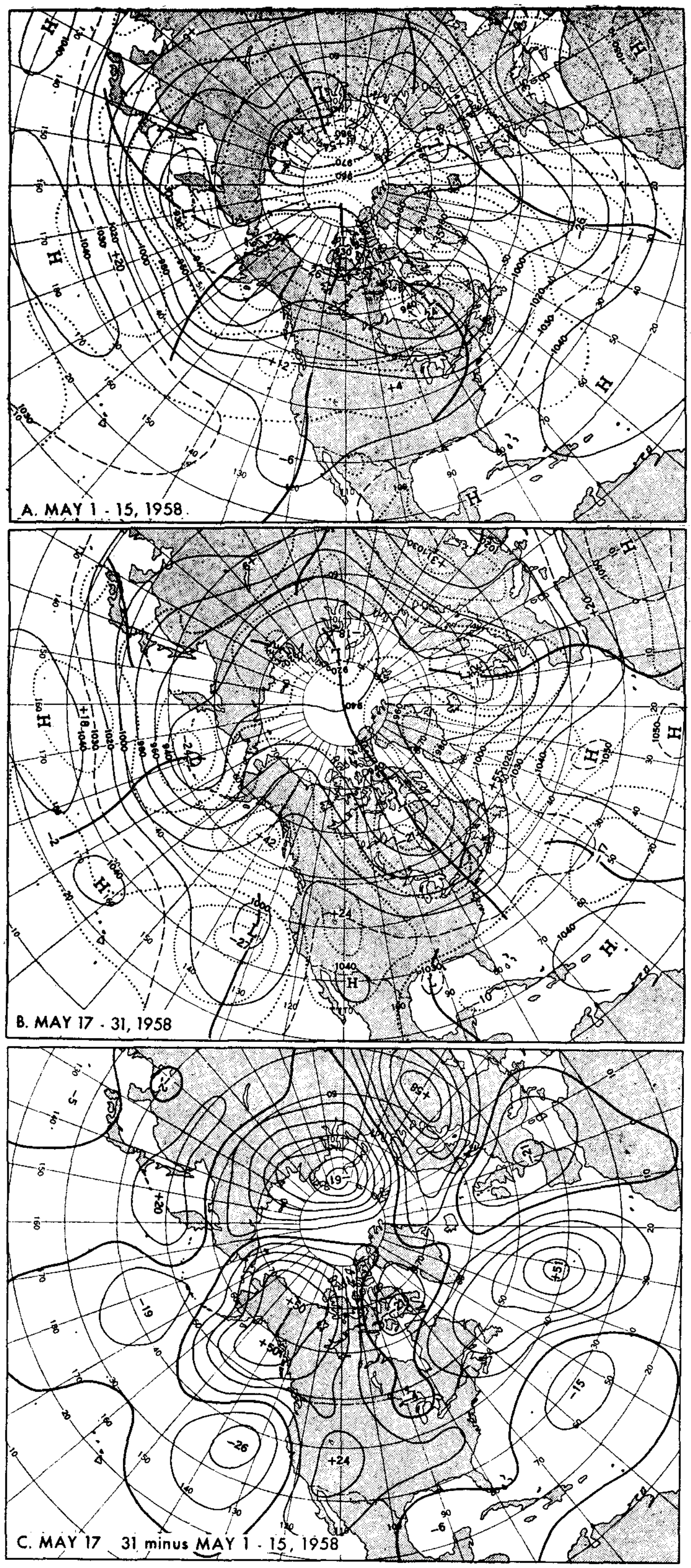


FIGURE 10.—Fifteen-day mean 700-mb. height contours (solid) and departures from normal (dotted) (both in tens of feet) for (A) May 1–15, 1958 and (B) May 17–31, 1958. (C) Difference in height between (A) and (B). Zonal circulation during the first half of May was replaced by a more meridional pattern during the latter half of the month.

From Asia to the mid-Pacific the mid-tropospheric circulation was much the same as it was during April [3]. The intense center of action in the Bering Sea moved slightly eastward from April to May with its sharply tilted trough extending southwestward to Japan (fig. 6). In the central Pacific the strong subtropical ridge, in association with the deep Bering Sea Low, maintained fast westerly flow across the western and central Pacific (figs. 3, 4, 6). At the 700-mb. level these winds were as much as 10 m. p. s. above normal. This strong westerly current separated into two branches in the eastern Pacific, one current flowing northeastward through the Gulf of Alaska, the other southeastward into the deep middle- and low-latitude trough in the eastern Pacific (fig. 3A). Wind speeds at 700 mb. in this latter area were much below normal (fig. 3B) as a result of the difluent circulation pattern.

One typhoon, named Phyllis, was observed in the Pacific during May. This storm, with sustained winds of 160 kt. and gusts to 200 kt., was first located on the 26th near 7° N., 150° E. Moving slowly northward in a weak low-latitude trough (fig. 6), the storm caused little damage before becoming extra-tropical on June 1.

7. INTRA-MONTHLY TRANSITION

Significant changes occurred in the general circulation between the first and second halves of May. These are best seen by reference to figure 10 which shows the mean 700-mb. maps for both halves of the month along with the height change between these charts. Areas of greatest change in the Western Hemisphere were found in northwestern North America and the central Atlantic (fig. 10C). The Pacific circulation during the first half of May was characterized by fast westerlies with two middle-latitude troughs and by difluence in the extreme eastern Pacific (fig. 10A). Amalgamation of these troughs during the latter half of the month increased the wavelength downstream, resulting in retrogression of the trough located near the Pacific coast of North America early in the month (fig. 10B). At the same time strong ridging occurred in western North America, the westerlies were displaced northward, difluence became more pronounced, and the eastern Pacific trough deepened and developed a closed center. These changes were accompanied by displacement northwestward of the High over Yucatan Peninsula to a position over northwestern Mexico (fig. 10A, B).

Of most direct influence upon the weather in the United States was the strengthening of the ridge and increase in heights from Mexico to Alaska (fig. 10C). The warmest weather in the West occurred during the latter half of May, with average temperatures for the week ending May 25 being as much as 15° F. above normal in northern Idaho [8]. Precipitation over the entire country averaged considerably less during the last half of May than it did during the first half. This is related directly to increased northerly flow components and to the rise in 700-mb. height anomaly over most of the Nation (fig. 10C).

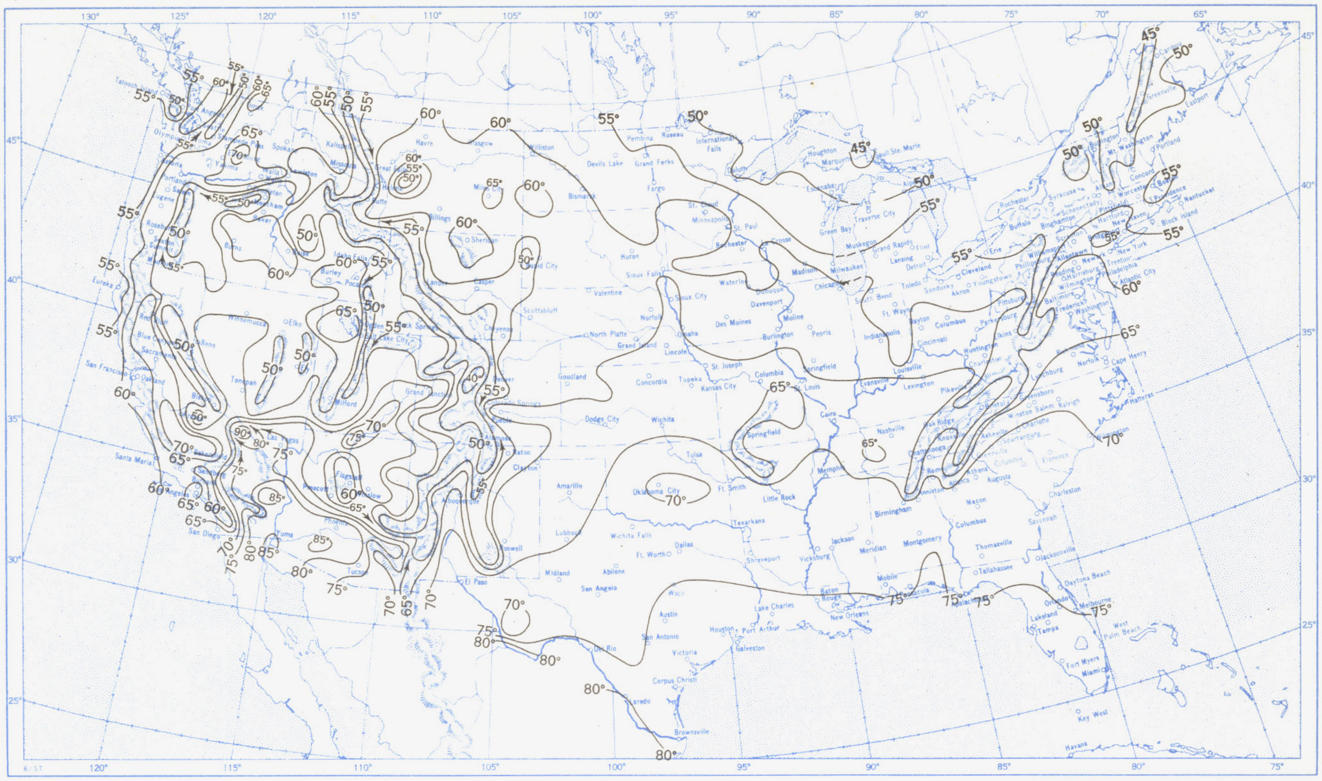
Pronounced ridging also occurred in the central Atlantic where 700-mb. heights rose as much as 510 ft. from the first half to the last half of May (fig. 10C). The genesis of a new mean trough near 52° W., to the south of this ridging. was accompanied by forward motion of the major trough-ridge systems in Europe, with the trough over eastern Europe being replaced by a ridge (fig. 10 A, B). In the latter area 700-mb. heights rose over 500 ft. (fig. 10C).

Perhaps the most striking change occurred over the Kara Sea north of the Siberian Arctic. Here an extensive High cell early in May was replaced by a deep cyclonic vortex during the latter part of the month, as heights fell 610 ft. (fig. 10C).

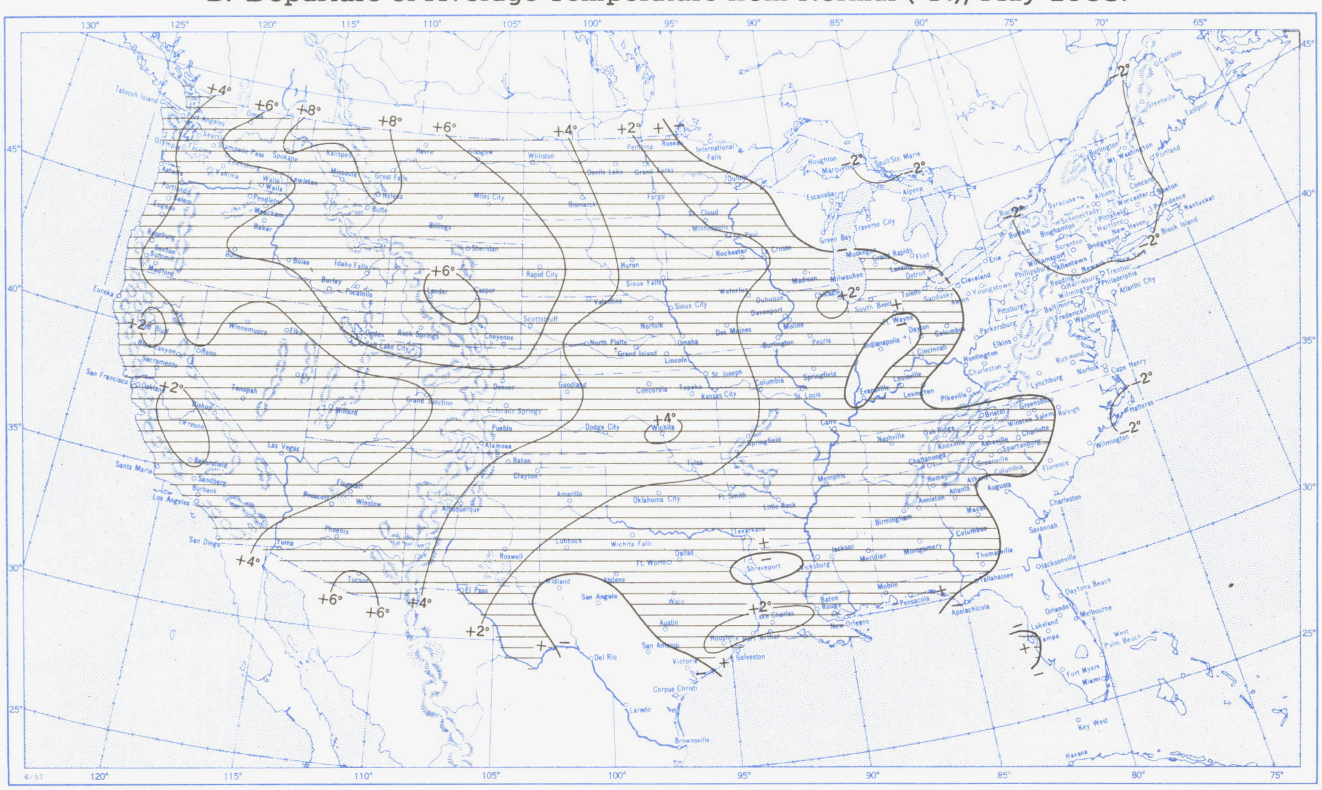
REFERENCES

1. W. H. Klein, "The Weather and Circulation of February 1958—A Month with an Expanded Circumpolar Vortex of Record Intensity," *Monthly Weather Review*, vol. 86, No. 2, Feb. 1958, pp. 60–70.
2. J. Namias, "Characteristics of the General Circulation Over the Northern Hemisphere During the Abnormal Winter 1946–47," *Monthly Weather Review*, vol. 75, No. 8, Aug. 1947, pp. 145–152.
3. P. Stark, "The Weather and Circulation of April 1958," *Monthly Weather Review*, vol. 86, No. 4, Apr. 1958, pp. 132–140.
4. J. Namias, "The Annual Course of Month-to-Month Persistence in Climatic Anomalies," *Bulletin of the American Meteorological Society*, vol. 33, No. 7, Sept. 1952, pp. 279–285.
5. W. H. Klein, "The Weather and Circulation of May 1954—A Circulation Reversal Effected by a Retrogressive Anticyclone During an Index Cycle," *Monthly Weather Review*, vol. 82, No. 5, May 1954, pp. 123–130.
6. W. H. Klein, "The Weather and Circulation of May 1956—Another April-May Reversal," *Monthly Weather Review*, vol. 84, No. 5, May 1956, pp. 190–197.
7. C. R. Dunn, "The Weather and Circulation of May 1957—A Month with Severe Floods and Devastating Tornadoes in the Southern Plains of the United States," *Monthly Weather Review*, vol. 85, No. 5, May 1957, pp. 175–182.
8. U. S. Weather Bureau, *Weekly Weather and Crop Bulletin, National Summary*, vol. XLV, No. 21, May 26, 1958.

Chart I. A. Average Temperature (°F.) at Surface, May 1958.

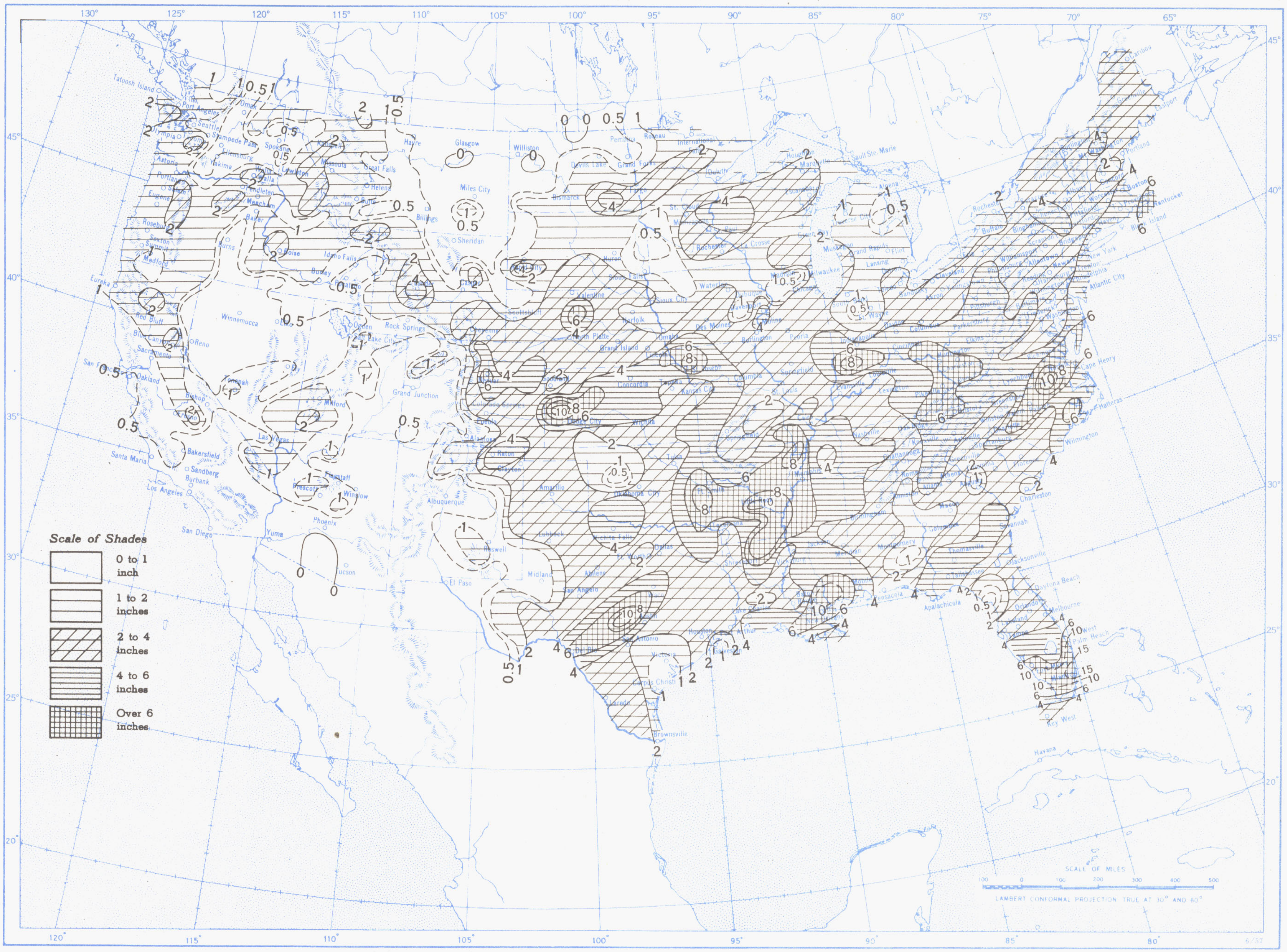


B. Departure of Average Temperature from Normal (°F.), May 1958.



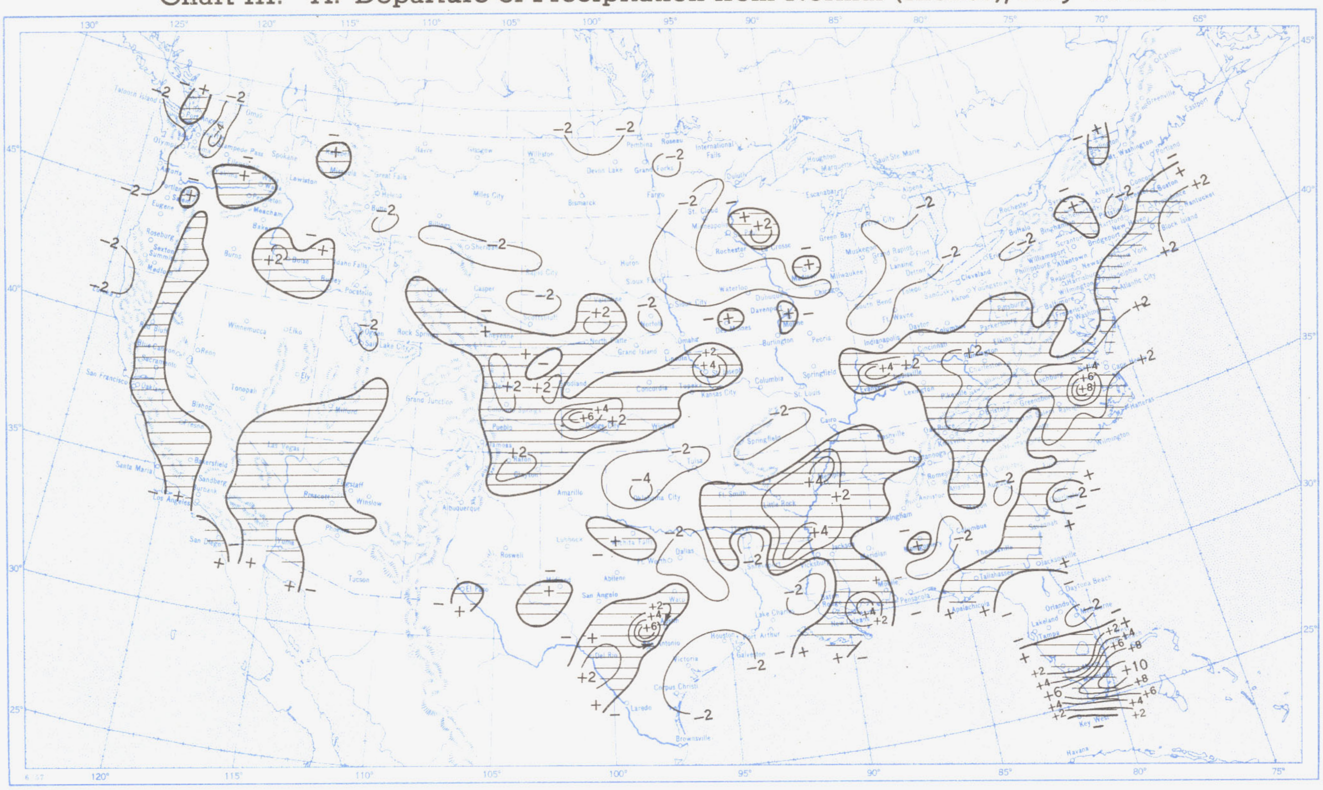
A. Based on reports from over 900 Weather Bureau and cooperative stations. The monthly average is half the sum of the monthly average maximum and monthly average minimum, which are the average of the daily maxima and daily minima, respectively.
B. Departures from normal are based on the 30-yr. normals (1921-50) for Weather Bureau stations and on means of 25 years or more (mostly 1931-55) for cooperative stations.

Chart II. Total Precipitation (Inches), May 1958.

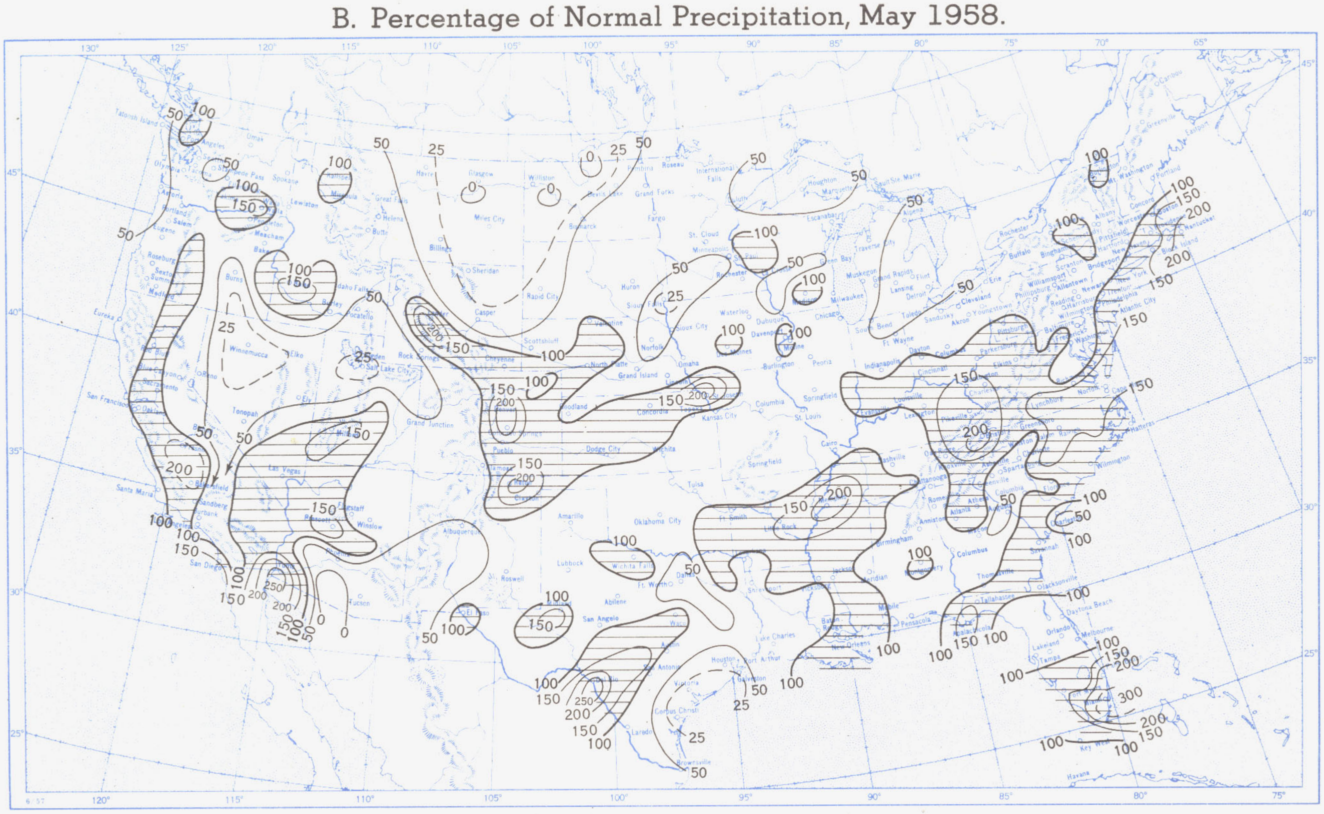


Based on daily precipitation records at about 800 Weather Bureau and cooperative stations.

Chart III. A. Departure of Precipitation from Normal (Inches), May 1958.

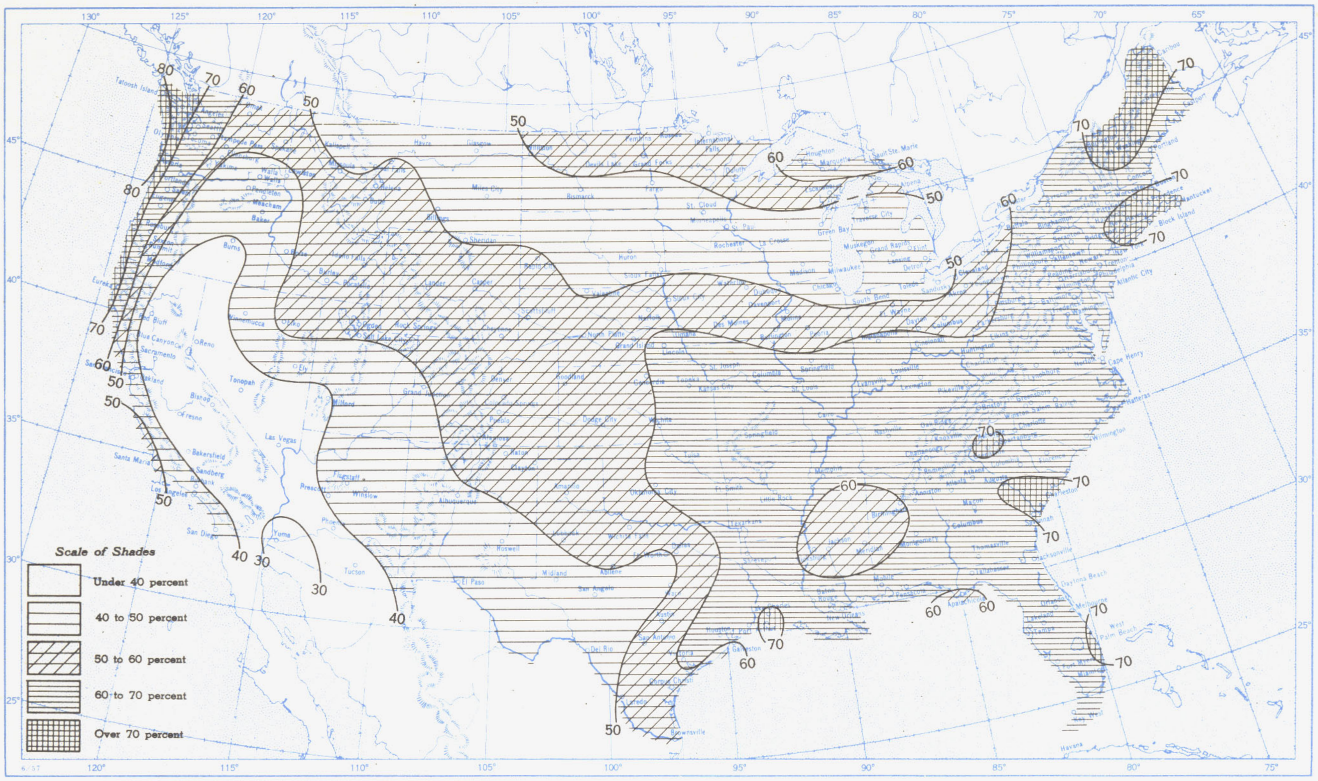


B. Percentage of Normal Precipitation, May 1958.

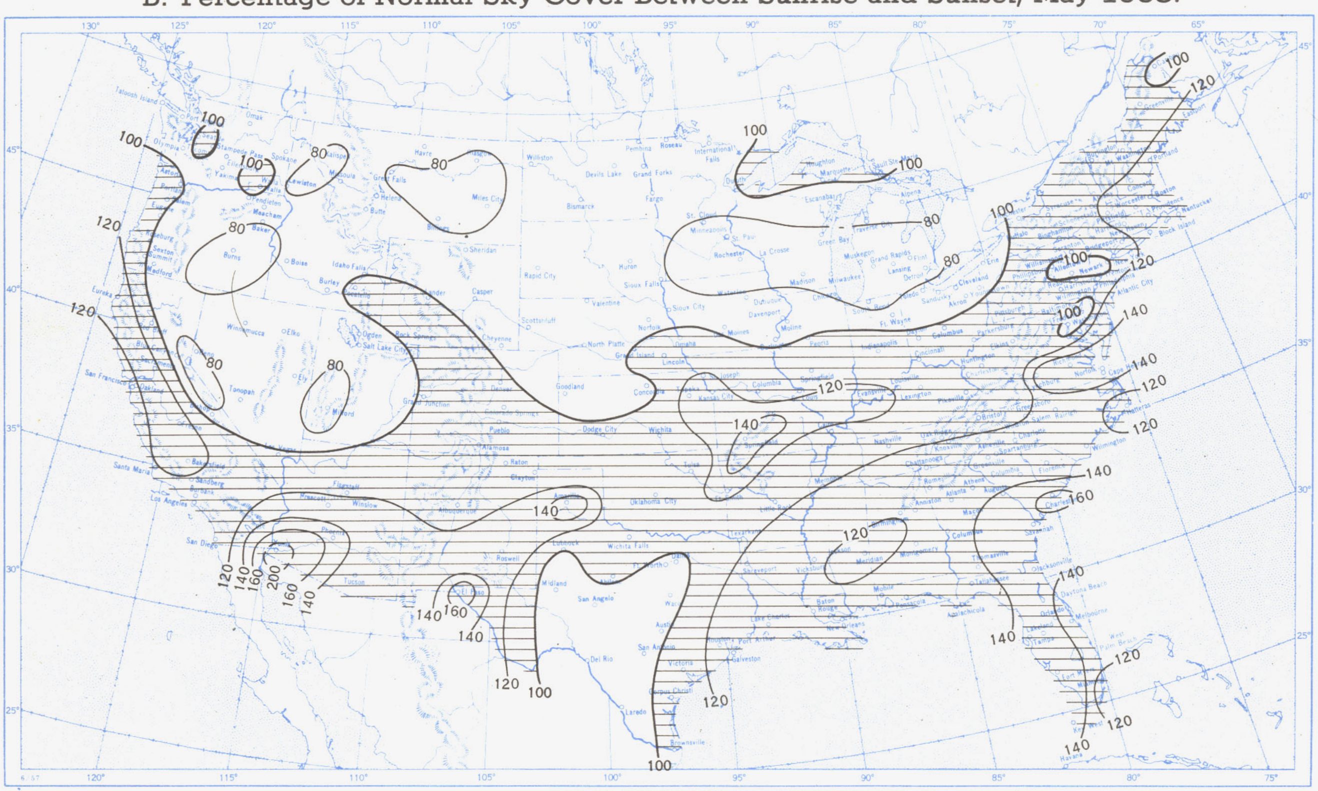


Normal monthly precipitation amounts are computed from the records for 1921-50 for Weather Bureau stations and from records of 25 years or more (mostly 1931-55) for cooperative stations.

Chart VI. A. Percentage of Sky Cover Between Sunrise and Sunset, May 1958.

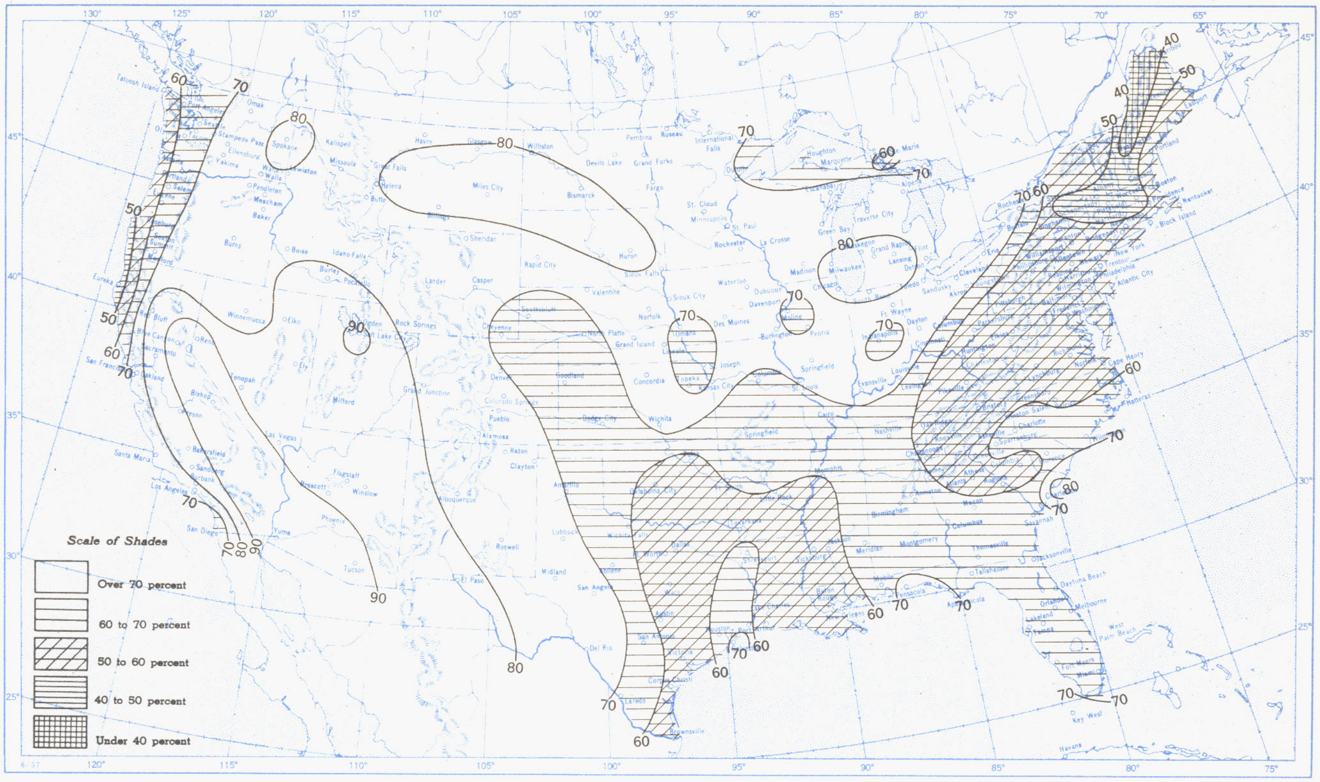


B. Percentage of Normal Sky Cover Between Sunrise and Sunset, May 1958.

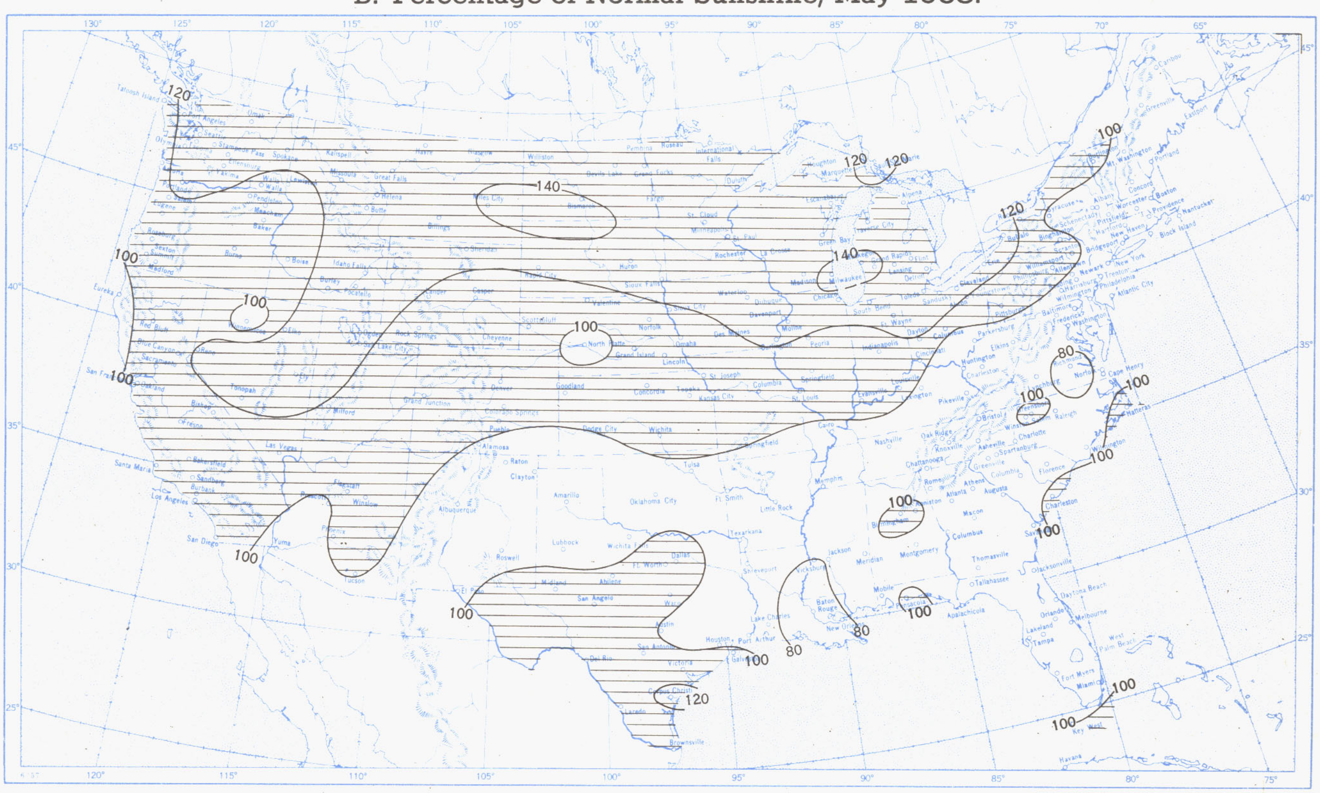


A. In addition to cloudiness, sky cover includes obscuration of the sky by fog, smoke, snow, etc. Chart based on visual observations made hourly at Weather Bureau stations and averaged over the month. B. Computations of normal amount of sky cover are made for stations having at least 10 years of record.

Chart VII. A. Percentage of Possible Sunshine, May 1958.



B. Percentage of Normal Sunshine, May 1958.



A. Computed from total number of hours of observed sunshine in relation to total number of possible hours of sunshine during month. B. Normals are computed for stations having at least 10 years of record.

Chart VIII. Average Daily Values of Solar Radiation, Direct + Diffuse, May 1958. Inset: Percentage of Mean Daily Solar Radiation, May 1958. (Mean based on period 1951-55.)

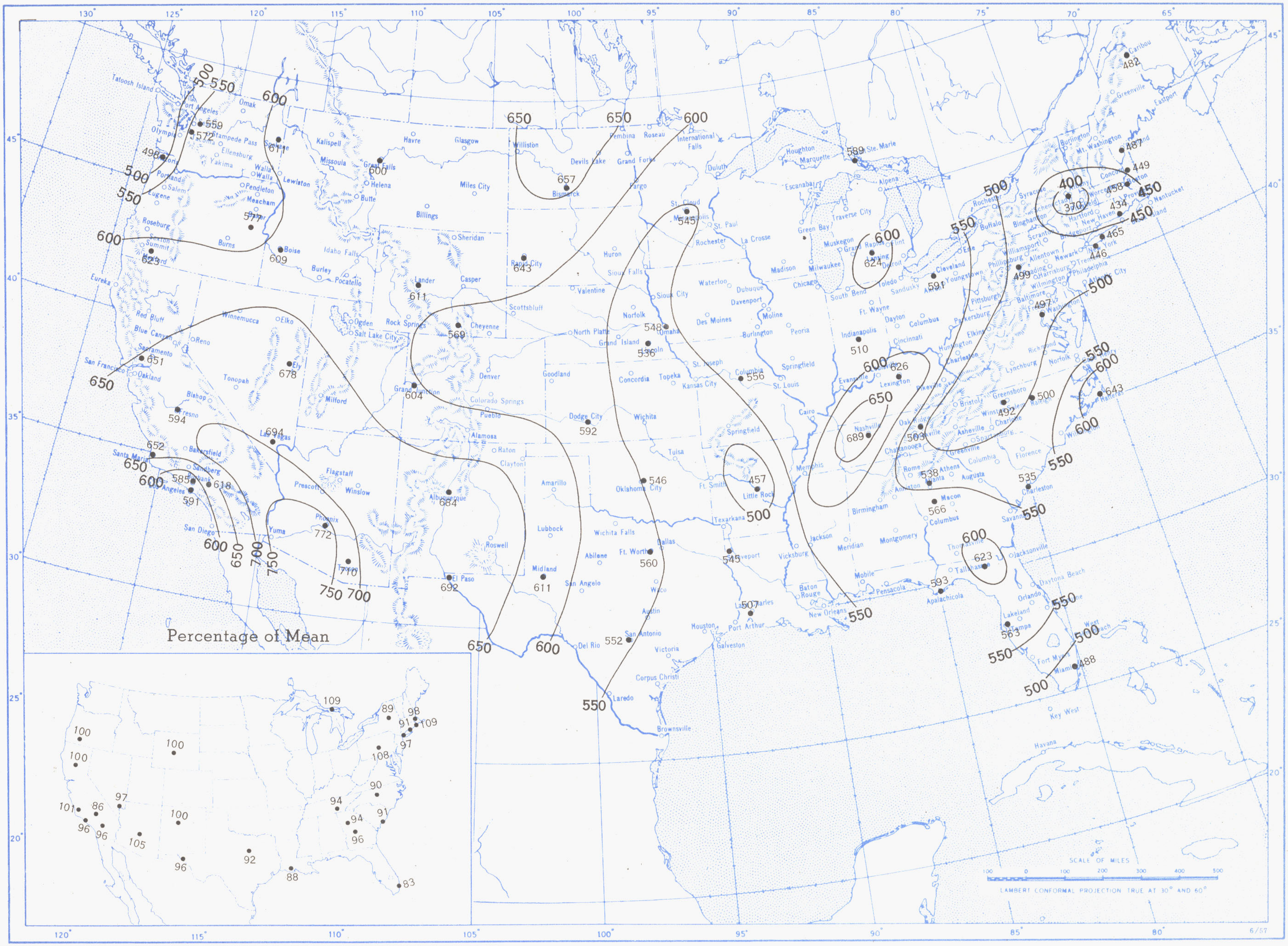
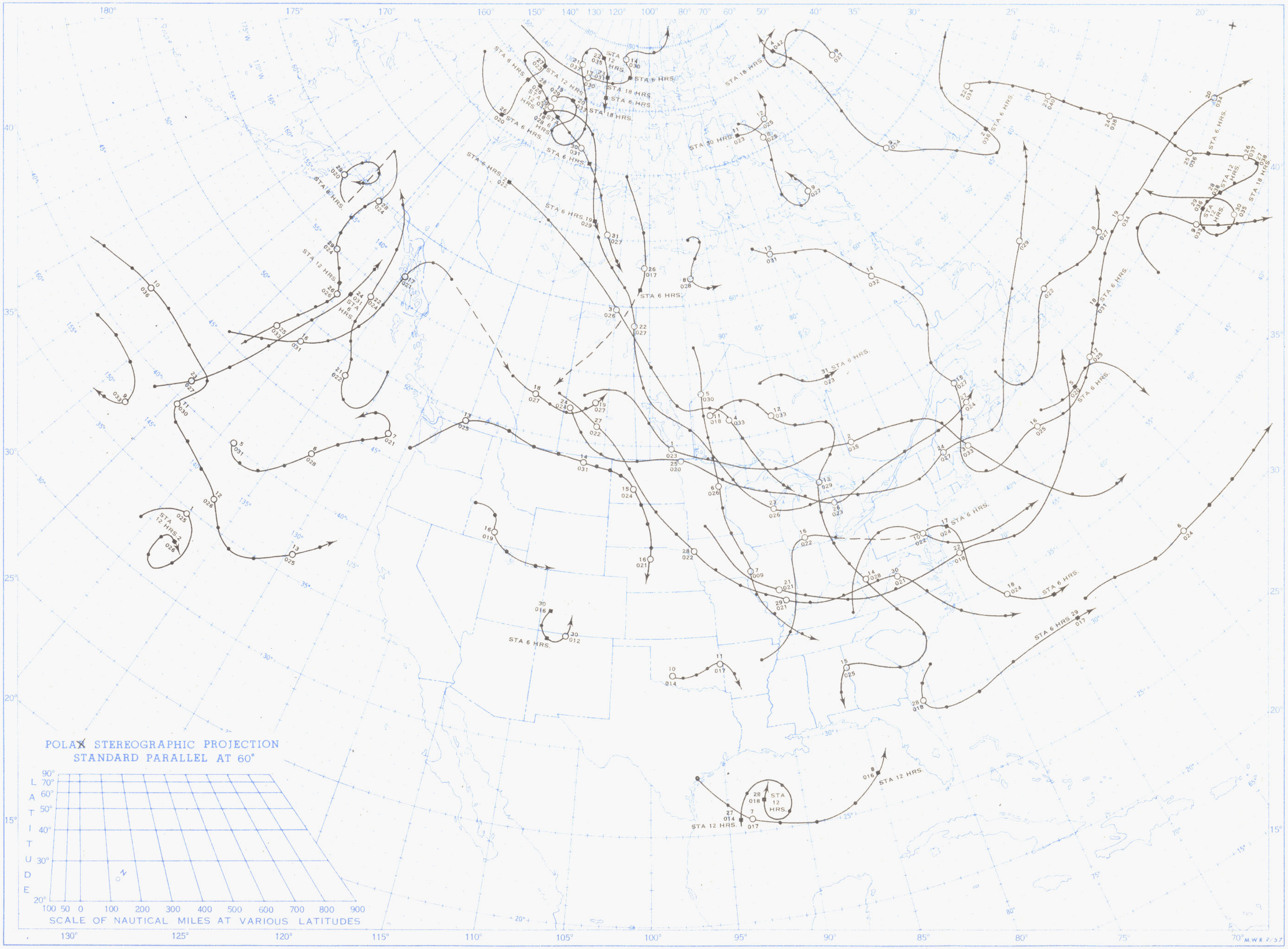


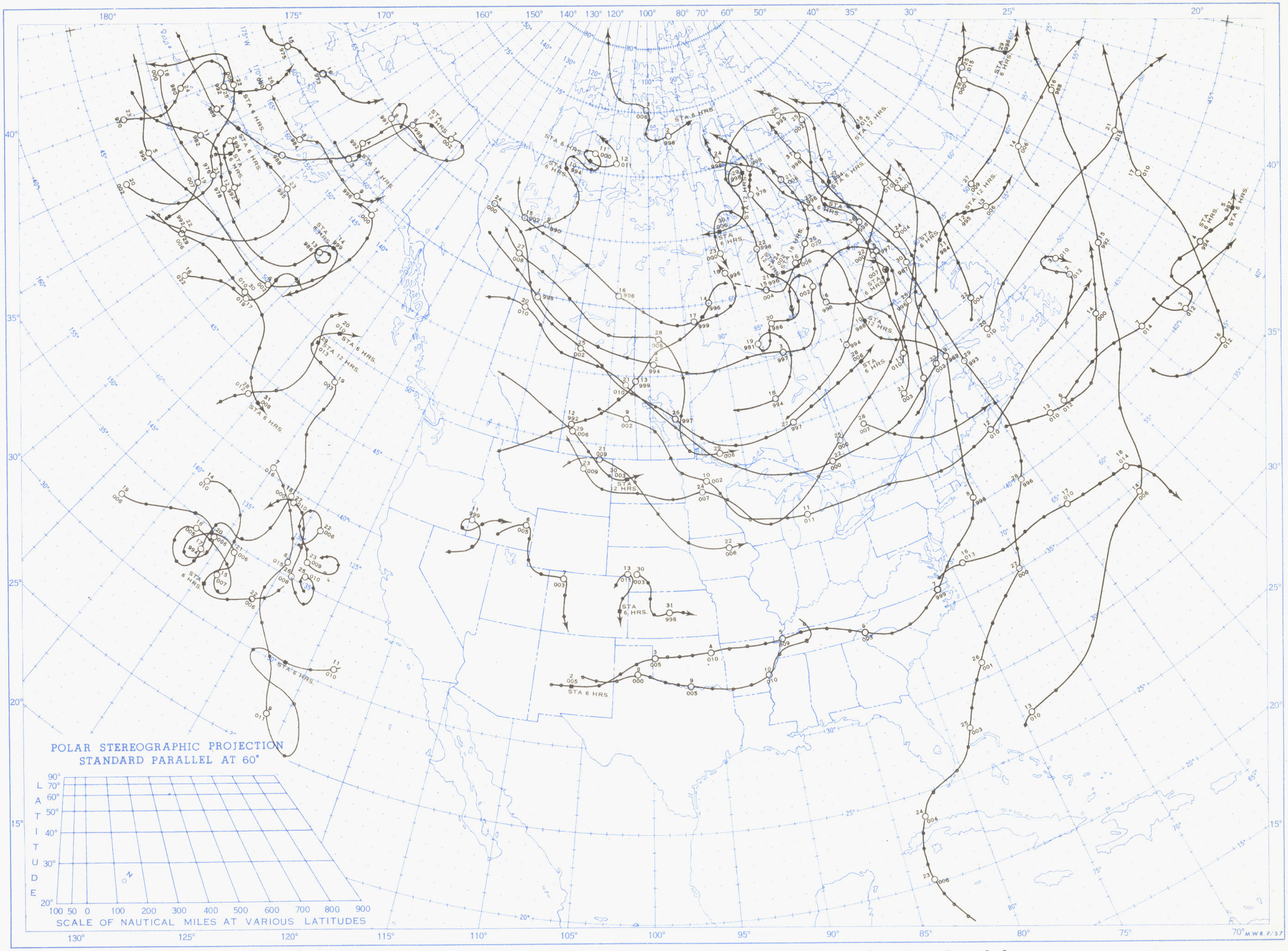
Chart shows mean daily solar radiation, direct + diffuse, received on a horizontal surface in langleys (1 langley = 1 gm. cal. cm. $^{-2}$). Basic data for isolines are shown on chart. Further estimates are obtained from supplementary data for which limits of accuracy are wider than for those data shown. The inset shows the percentage of the mean based on the period 1951-55.

Chart IX. Tracks of Centers of Anticyclones at Sea Level, May 1958.



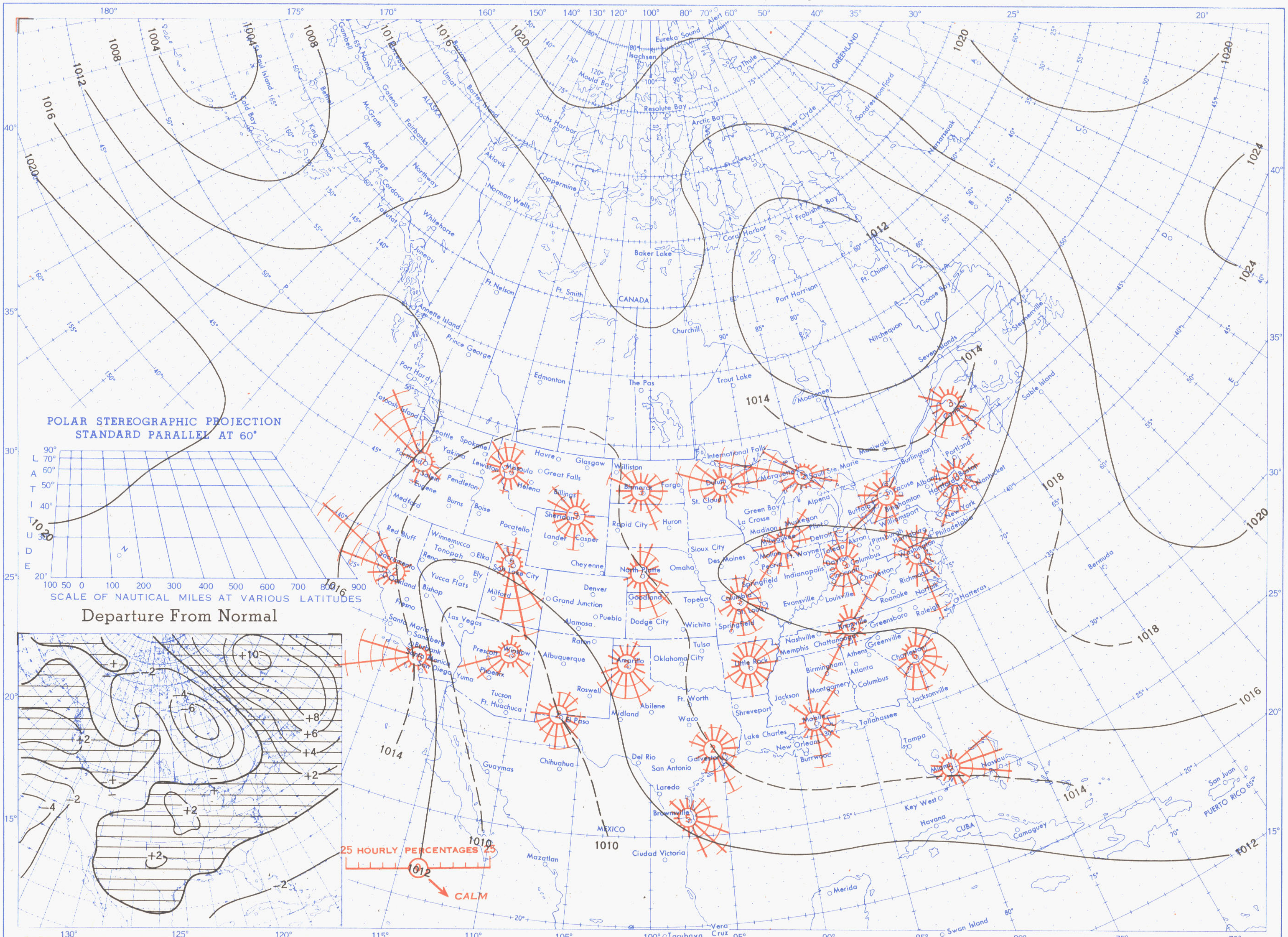
Circle indicates position of center at 7:00 a. m. E. S. T. Figure above circle indicates date, figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Squares indicate position of stationary center for period shown. Dashed line in track indicates reformation at new position. Only those centers which could be identified for 24 hours or more are included.

Chart X. Tracks of Centers of Cyclones at Sea Level, May 1958.



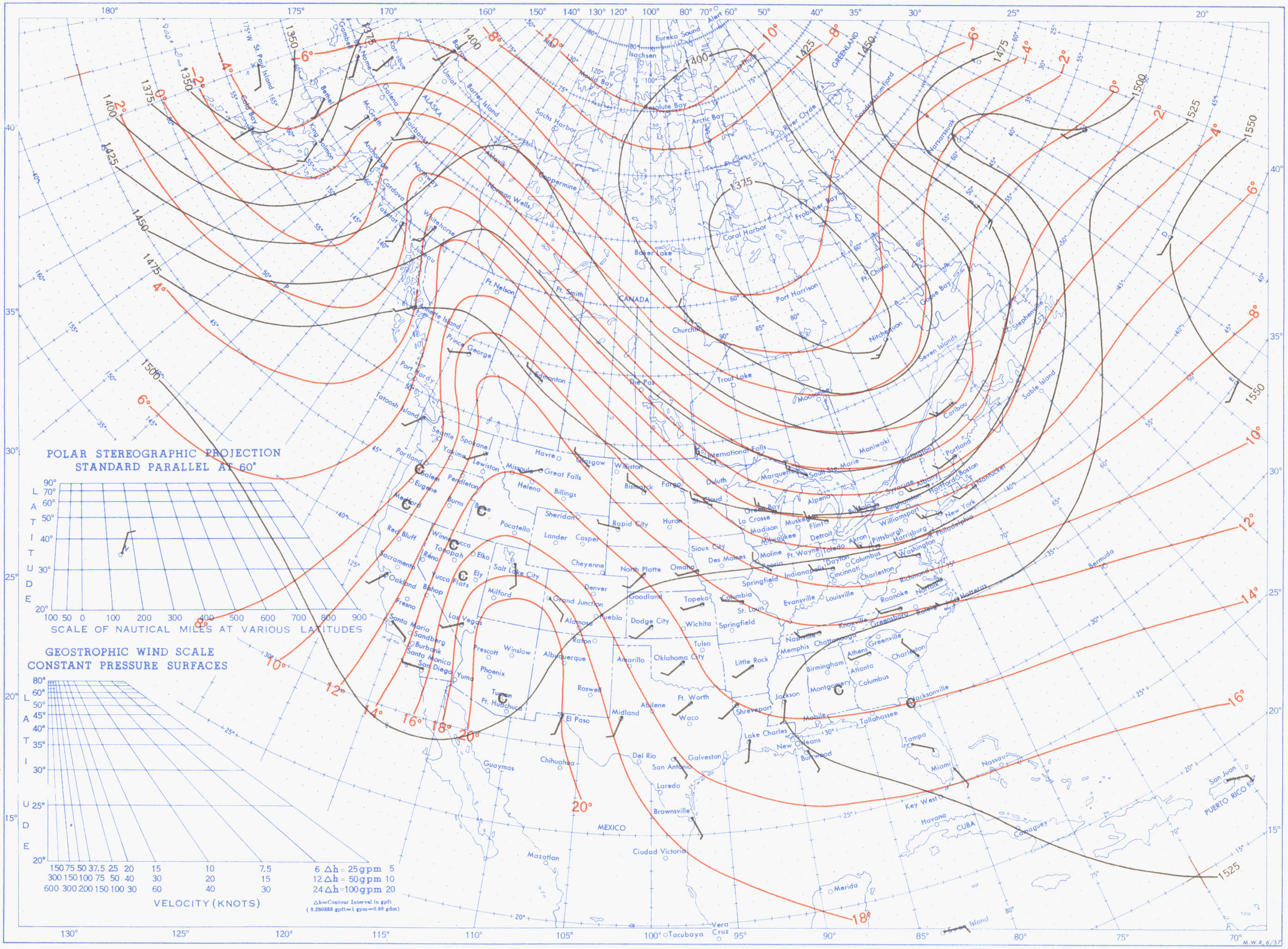
Circle indicates position of center at 7:00 a. m. E. S. T. See Chart IX for explanation of symbols.

Chart XI. Average Sea Level Pressure (mb.) and Surface Windroses, May 1958. Inset: Departure of Average Pressure (mb.) from Normal, May 1958.



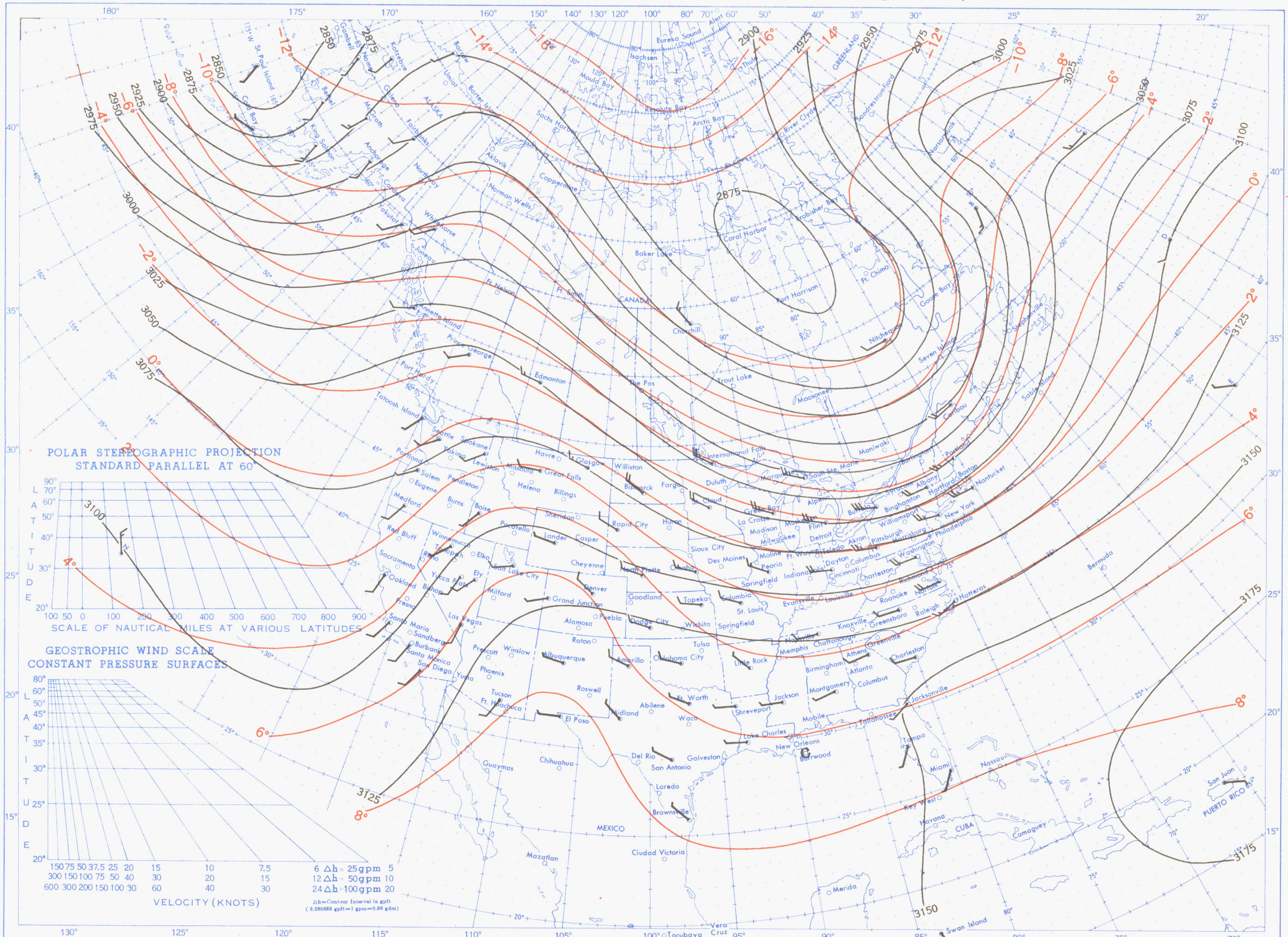
Average sea level pressures are obtained from the averages of the 7:00 a.m. and 7:00 p.m. E.S.T. readings. Windroses show percentage of time wind blew from 16 compass points or was calm during the month. Pressure normals are computed for stations having at least 10 years of record and for 10° intersections in a diamond grid based on readings from the Historical Weather Maps (1899-1939) for the 20 years of most complete data coverage prior to 1940.

Chart XII. 850-mb. Surface, 1200 GMT, May 1958. Average Height and Temperature, and Resultant Winds.



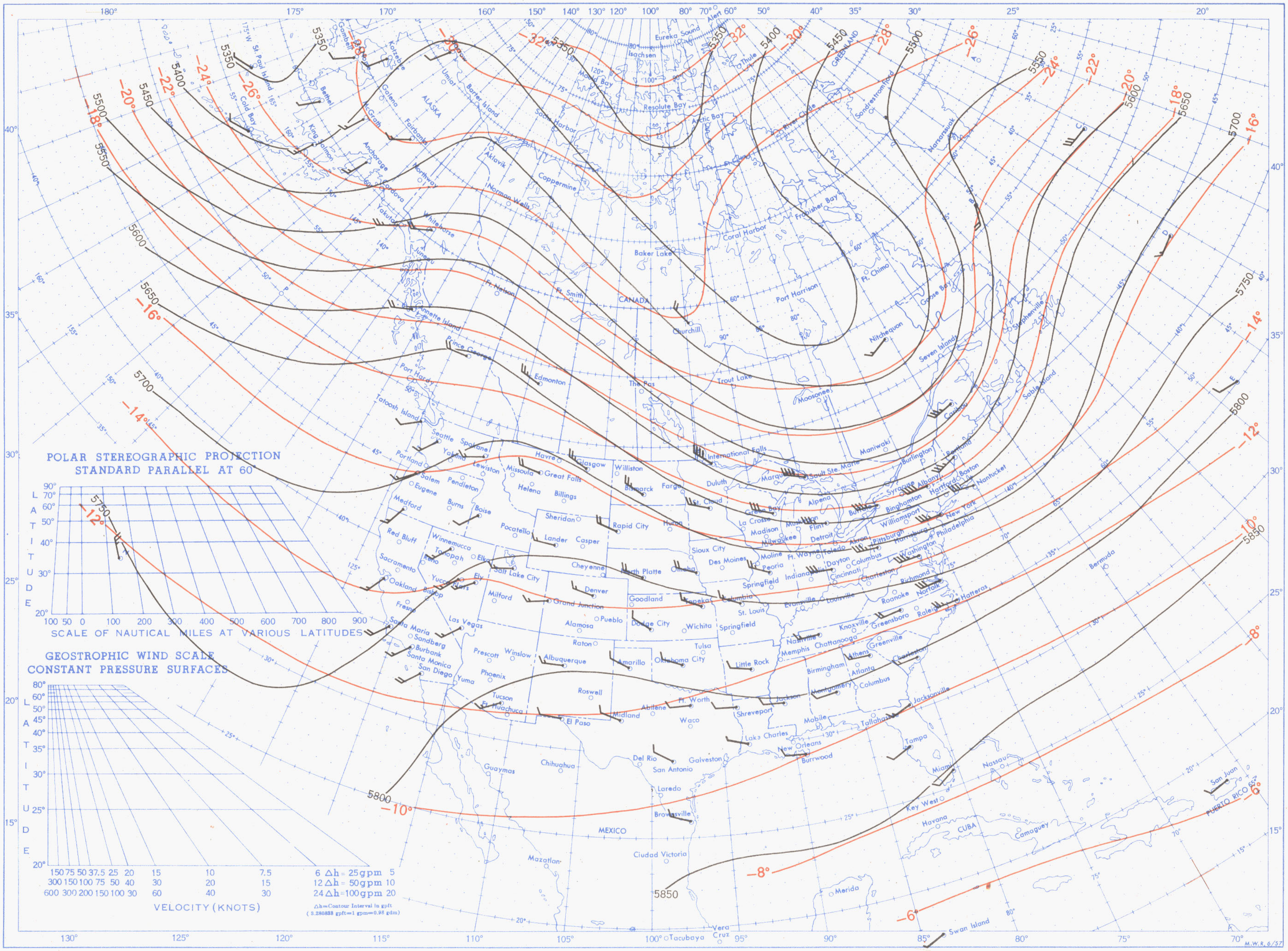
Height in geopotential meters (1 g.p.m. = 0.98 dynamic meters). Temperature in °C. Wind speed in knots; flag represents 50 knots, full feather 10 knots, and half feather 5 knots. All wind data are based on rawin observations.

Chart XIII. 700-mb. Surface, 1200 GMT, May 1958. Average Height and Temperature, and Resultant Winds.



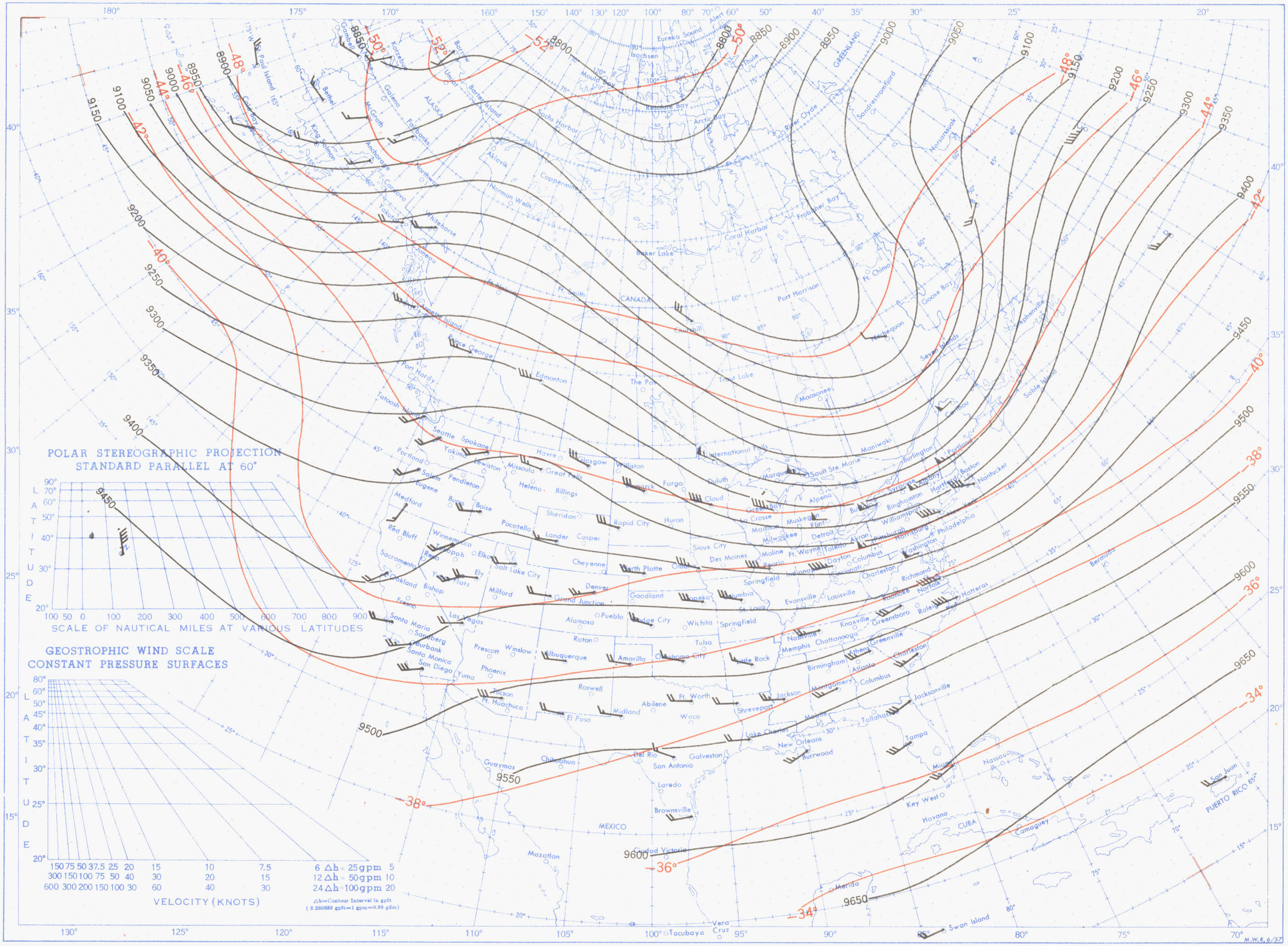
See Chart XII for explanation of map.

Chart XIV. 500-mb. Surface, 1200 GMT, May 1958. Average Height and Temperature, and Resultant Winds.



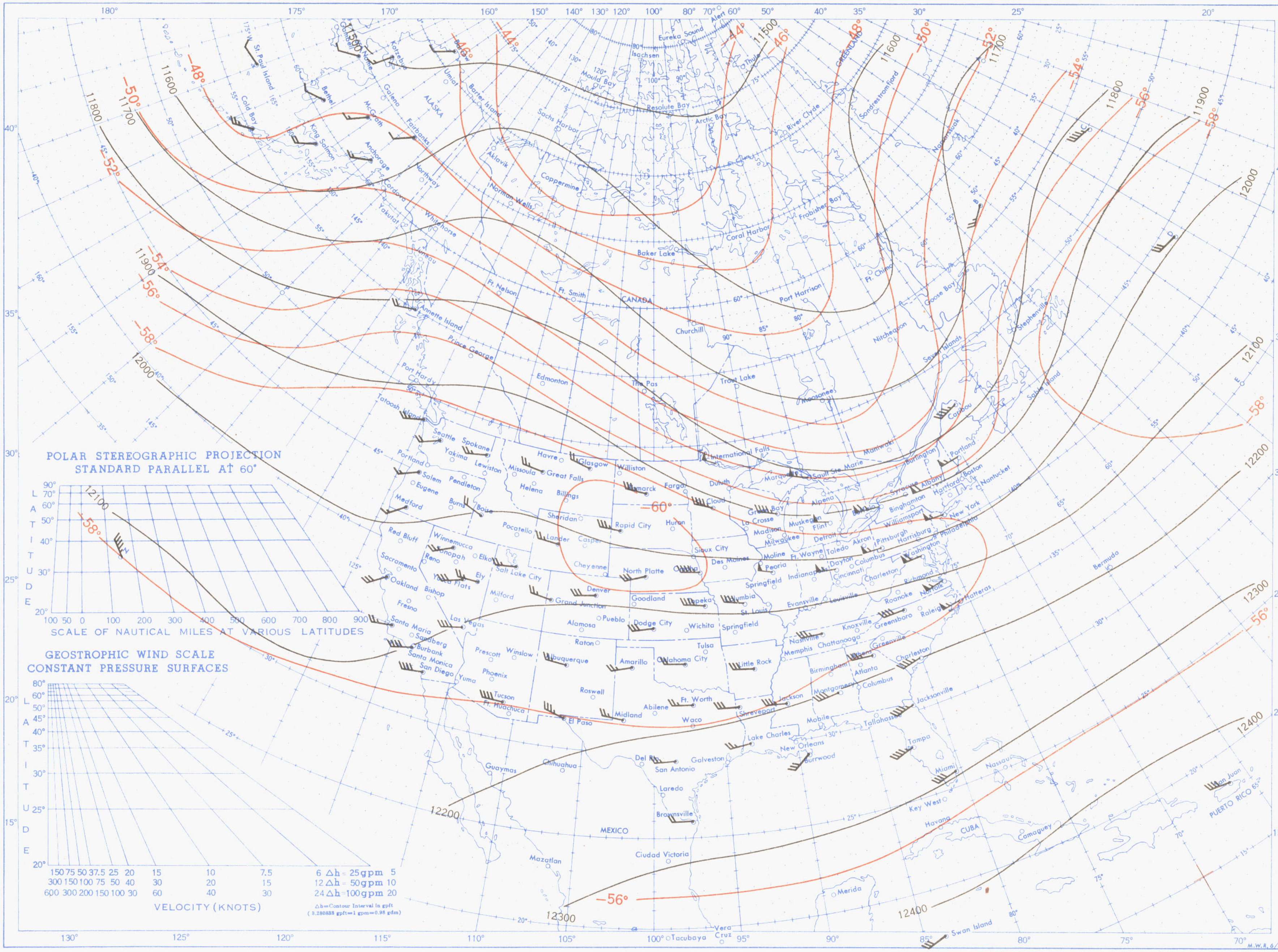
See Chart XII for explanation of map.

Chart XV. 300-mb. Surface, 1200 GMT, May 1958. Average Height and Temperature, and Resultant Winds.



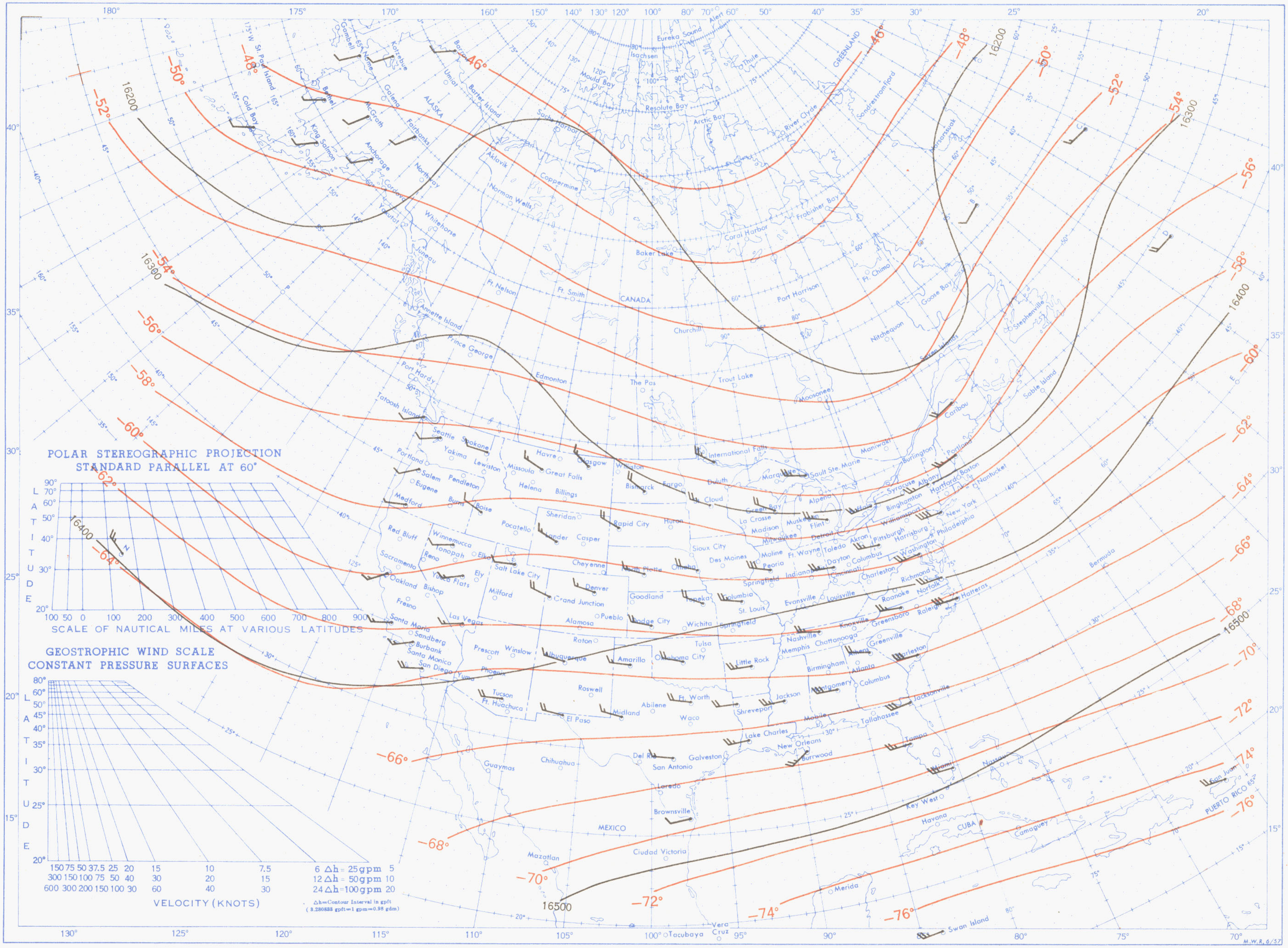
See Chart XII for explanation of map.

Chart XVI. 200-mb. Surface, 1200 GMT, May 1958. Average Height and Temperature, and Resultant Winds.



See Chart XII for explanation of map.

Chart XVII. 100-mb. Surface, 1200 GMT, May 1958. Average Height and Temperature, and Resultant Winds.



See Chart XII for explanation of map.